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# Animated Simulation: Determining Cost Effective Nurse Staffing for an Acute Care Unit

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The purpose of this research project was to determine the appropriate mix of nursing personnel on the day shift for a given workload. The top management team at the Milwaukee Veterans Affairs Medical Center (VAMC) has questioned nursing staffing methodologies for several years. Nurse executives have been unable to educate the top management team on nurse staffing methodologies because they lacked quantifiable data to support the nurse staffing methodologies. Recently, the Department of Veteran Affairs Central Nursing Office instituted a new staffing methodology, called the Expert Panel-Based Methodology. Since this methodology once again utilized subjective data and individual judgments, the top management team was uncertain of its validity.

Empirical data was collected for the time studies and retrospective data was analyzed in order to obtain a historical perspective on admissions, discharges, transfers onto the unit, transfers off the unit, average census, and cardiac catheterizations. This data was placed into a statistical package, Stat::Fit, and the appropriate distributions were assigned to each measurement.

The flow of the nursing unit's day shift was modeled in the computer simulation program, MedModel 3.01. A separate program was developed for each day of the week. The researcher then varied the staffing and determined the appropriate nurse staffing mix for the average daily census at the beginning of the shift and the workload for each day of the week.

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# Executive Summary

The purpose of this research project was to determine the appropriate mix of nursing personnel on the day shift for a given workload. The top management team at the Milwaukee Veterans Affairs Medical Center (VAMC) has questioned nursing staffing methodologies for several years. Nurse executives have been unable to educate the top management team on nurse staffing methodologies because they lacked quantifiable data to support the nurse staffing methodologies. Recently, the Department of Veterans Affairs Central Nursing Office instituted a new nurse staffing methodology, called the Expert Panel-Based Methodology. Since this methodology once again utilized subjective data and individual judgments, the top management team was uncertain of its validity.

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The flow of the nursing unit's day shift was modeled in the computer simulation program, MedModel 3.01. A separate program was developed for each day of the week. The researcher then varied the staffing and determined the appropriate nurse staffing mix for the average daily census at the beginning of the shift and the workload for each day of the week.

Recommended FTEE for the Given Workload on the Day Shift

| FTEE | Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|---|
| Registered Nurses | 4.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.5 | 4.0 |
| Nursing Assistant | 1.5 | 1.5 | 3.0 | 2.5 | 2.5 | 2.0 | 2.0 |

Note: These nurse staffing numbers do not include a telemetry technician

The nurse staffing for the day shift was more than expected. Further research is needed to determine if workload from the day shift can be shifted to the other shifts. Additionally, the Milwaukee VAMC may need to educate their physicians on how they order tests, procedures, vital signs, etc. If these orders were consolidated into fewer time frames and discontinued when no longer necessary, nursing workload would decrease.

# TABLE OF CONTENTS

ACKNOWLEDGMENT ..... i

EXECUTIVE SUMMARY ..... ii

LIST OF GRAPHS ..... v

LIST OF TABLES ..... vi

LIST OF ABBREVIATIONS ..... ix

**CHAPTER 1: INTRODUCTION** ..... 1

Conditions Which Prompted the Study ..... 2
Statement of the Problem ..... 10
Literature Review ..... 11
Issues Relevant to Nurse Staffing ..... 11
Current Nurse Staffing Methodologies ..... 15
Computer Simulation: Defined ..... 18
Computer Simulation in Health Care ..... 21
Purpose of the Study ..... 25

**CHAPTER 2: METHODS AND PROCEDURES** ..... 26

Computer Simulation ..... 26
Patient Outcomes ..... 26
Variables ..... 27
Competencies of Each Type of Nursing Employee ..... 28
Hours of Operation ..... 29
Ethical Considerations ..... 29
Validity of the Simulation Model ..... 29

**CHAPTER 3: THE DATA COLLECTION PROCESS** ..... 31

**CHAPTER 4: THE SIMULATION PROCESS** ..... 42

**CHAPTER 5: FINDINGS AND UTILITY OF RESULTS** ..... 82

**CHAPTER 6: RESULTS AND RECOMMENDATIONS** ..... 83

**CHAPTER 7: CONCLUSION** ..... 86

ATTACHMENT A ACUTE CARE NURSING QUALITY INDICATORS ..... 87

ATTACHMENT B A PICTORIAL OF 5CN ..... 88

ATTACHMENT C ARRAY OF PATIENT CARE ACTIVITIES ..... 89

REFERENCES ..... 90

# List Of Graphs

Graph 1.1 Acute Care Operating Beds ..... 7

Graph 1.2 Acute Care Average Daily Census..... 8

# List Of Tables

Table 1.1 Acute Care Nursing FTEE ..... 9

Table 3.1 Admissions To 5CN ..... 32

Table 3.2 Discharges Off 5CN ..... 32

Table 3.3 Transfers Onto 5CN ..... 32

Table 3.4 Transfers Off 5CN ..... 32

Table 3.5 COTC Patients To 5CN ..... 33

Table 3.6 Cardiac Catheterization Patients On 5CN ..... 33

Table 3.7 Scheduled Surgical Patients On 5CN ..... 33

Table 3.8 Non-IV Medication Administration ..... 36

Table 3.9 PRN Medications ..... 36

Table 3.10 Intravenous (IV) Mini Bags ..... 37

Table 3.11 Procedures/Tests Performed On 5CN ..... 37

Table 3.12 Vital Signs ..... 37

Table 3.13 Weights ..... 38

Table 3.14 Frequency Of Treatments ..... 38

Table 3.15 Physical Therapy Appointments at 10:00 and 14:30 ..... 38

Table 3.16 Intake and Output ..... 39

Table 3.17 Patient Call Bells ..... 39

Table 3.18 Finger Sticks ..... 39

Table 3.19 Time Distributions for Patient Care Activities ..... 41

Table 4.1 Time Line for Nursing Workload On 5CN's Tuesdays-Day Shift ..... 42

Table 4.2 Processing Logic for Clock Subroutine ..... 48

Table 4.3 Processing Logic for 9AM Vital Signs At Nurses Station ..... 49

Table 4.4 Arrivals ..... 50

Table 4.5A Sunday - Activity Level and Resource Runs ..... 54

Table 4.5B Sunday - Remaining Entities After The Day Shift ..... 55

Table 4.6A Monday - Activity Level and Resource Runs ..... 58

Table 4.6B Monday - Remaining Entities After The Day Shift ..... 69

Table 4.7A Tuesday - Activity Level and Resource Runs ..... 62

Table 4.7B Tuesday - Remaining Entities After The Day Shift ..... 63

Table 4.8A Wednesday - Activity Level and Resource Runs ..... 66

Table 4.8B Wednesday - Remaining Entities After The Day Shift ..... 67

Table 4.9A Thursday - Activity Level and Resource Runs ..... 70

Table 4.9B Thursday - Remaining Entities After The Day Shift ..... 71

Table 4.10A Friday - Activity Level and Resource Runs ..... 74

Table 4.10B Friday - Remaining Entities After The Day Shift ..... 75

Table 4.11A Saturday - Activity Level and Resource Runs ..... 78

Table 4.11B Saturday - Remaining Entities After The Day Shift ..... 79

Table 6.1 Nurse Staffing Recommendations For 5CN's Day Shift..... 83

# List Of Abbreviations


VAMC Veterans Affairs Medical Center ..... 2

VA Veterans Affairs ..... 2

FTEE Full Time Equivalent ..... 5

FY Fiscal Year ..... 7

ADC Average Daily Census ..... 7

ANA American Nurses Association ..... 11

AACN American Association of Colleges of Nursing ..... 11

IOM Institute of Medicine ..... 12

RNs Registered Nurses ..... 15

LPNs Licensed Practical Nurses ..... 15

NAs Nursing Assistants ..... 15

CAD Computer Assisted Design ..... 26

COTC Coordinated Outpatient Testing Center ..... 34

PRN As needed ..... 36

# CHAPTER 1

# INTRODUCTION

In this era of re-engineering and right-sizing, health care administrators are seeking cost containment initiatives, which include staff reductions. Since nursing employees typically comprise the major portion of total facility employees, they are the first targeted audience for reductions. This is a logical reaction because even a small reduction in nurse staffing would demonstrate large fiscal savings. Although health care executives target reductions in nurse staffing levels, they are reluctant to proceed because they do not understand nurse staffing methodologies.

Determining how many resources it takes to manage a health care facility is a challenge and becomes even more complex when staffing methodologies are based on subjective data. Nursing leaders perplex health care executives by validating nurse staffing needs with nurse staffing patterns, patient categories, and other unquantifiable nursing terminology. Since health care executives are unable to comprehend these subjective nurse staffing methodologies, they are unable to make justifiable decisions regarding appropriate nursing levels.

Therefore, a quantifiable nurse staffing methodology is needed to eliminate health care executives' uncertainty and enable them to make informed decisions on appropriate nurse staffing levels.

## *Conditions Which Prompted the Study*

The top management team at the Milwaukee Veterans Affairs Medical Center (VAMC) has concerns with nurse staffing levels. Nurse executives continue to support the current levels and types of nursing personnel, however, nursing leaders are unable to provide objective and quantifiable data to support their claim. Therefore, the top management team remains bewildered regarding nurse staffing and continues to search for a methodology that will provide quantifiable and objective data so they can rationally identify appropriate nurse staffing levels on each unit in this tertiary care facility.

In the early 1980's, the Department of Veterans Affairs (VA) Nursing Service implemented a staffing methodology based on patient categories. Work study sampling was performed to establish mean hours of direct nursing care as well as the non-direct nursing care hours for each patient category. Recently, this staffing methodology was questioned by VA Nursing Service. They questioned the validity of this methodology because it did not incorporate professional judgment, it had interrater-reliability issues, it was not unit or even facility

specific, and the guidelines for the methodology had not been updated since its inception in 1982. VA Nursing Service also questioned if this patient category staffing methodology accurately measured patient care activities which in turn determined patient acuity and hours of nursing care (Dunn, Norby, Cournoyer, Hudec, O'Donnell, & Snider, 1995). Taking into consideration these concerns, VA Nursing Service began to investigate the validity of this staffing methodology (Blazey, Cournoyer, Dunn, Hudec, Lund, Norby, O'Donnell, Snider, & Williams, 1996).

VA Nursing Service initiated this nation wide patient category staffing methodology in 1982. A patient's category, at any VA facility across the nation, was determined by having the nurse select patient-specific factors from a set of patient care activities. These factors varied depending upon the area. Using an acute surgical area as an example, the activities included: IV administration, mobility, activities of daily living, nutrition, and continuous monitoring. After the nurse selected the appropriate factors for a given patient, the computer then determined the patient's acuity level or patient category (Department of Veterans Affairs, 1996). VA Nursing Service identified flaws in this methodology and began to pursue the search for a staffing methodology to correct the identified deficiencies.

In response to the ongoing issue of nurse staffing, VA Nursing Service formed a Consultants' Group on Nurse Staffing Guidelines. This group consisted of several VA nursing executives and distinguished staffing experts. This group discussed nurse staffing methodologies and presented two specific recommendations:

(1) Develop a demonstration model using a philosophical framework based on the patient's movement from a state of dependency to independency from which data elements that would identify the resources required for a nursing service could be determined.

(2) Review and identify data needs related to the provision of nursing services to support decision making at all organizational levels within VA (Blazey, et al., 1996).

The Consultants' Group also determined that the best estimate of nurse staffing needs within each facility is made by experienced nurses working on each unit. From these recommendations, VA Nursing Service derived the Expert Panel-Based Methodology for Nurse Staffing and Resource Management.

This new Expert Panel-Based Methodology requires each facility to develop an expert panel, which is an advisory panel on nurse staffing. Once the expert panel is functional, each unit must conduct a comprehensive review of data specifically related to patient work load and nurse staffing needs. After this is

accomplished, the manager of each unit is required to project nurse staffing needs by personnel category for direct patient care and additional staffing needs for indirect patient care e.g., education, quality improvement, research, etc. Patient outcome indicators specific to each unit's patient population and patient acuity or patient categories also plays an important part in determining staffing needs. These projected staffing needs are submitted to the expert panel along with the rationale for the identified staffing levels. The expert panel then makes a final decision on the staffing level for each unit. The expert panel's decision is based on the philosophy of the Medical Center, full time equivalent (FTEE) constraints, and other issues relevant to nurse staffing and the particular Medical Center (Blazey, et al., 1996).

After the expert panel approves the projected staffing for each unit, the unit then posts: (1) a staffing level for the unit, specific for each category of nursing personnel and (2) a staffing pattern for each shift based on an average daily census, the average patient acuity, a specific amount of patient outcomes/ standards, and the number of the five most frequently occurring patient problems requiring nursing care on an average day. This data now serves as a staffing guideline for the particular unit. However, this master staffing plan is only relevant for the projected average patient census, the identified number of patient problems, and the average number of patients in each category. When patient

census varies, the amount of patient problems requiring nursing care vacillates, or patient acuity fluctuates, then nurse staffing levels are modified by the unit manager. These modifications are based on the unit manager's past experience and expertise.

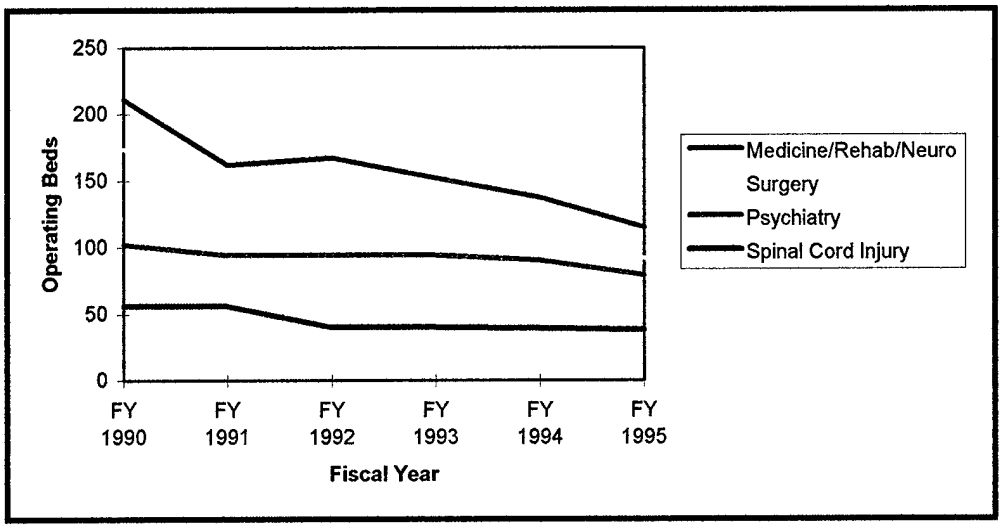
The Expert Panel-Based Methodology has been in place at the Milwaukee VAMC since January, 1996. VA nurse executives find this methodology superior to the previous patient classification methodology, because it takes into account patient outcomes, recognizes variability in patient acuity, census, etc., and relies on the unit managers expertise in staffing a particular unit. Additionally, this staffing methodology requires a review of the nurse staffing levels to occur at least every six months or more frequently if changes occur such as unit consolidations or changes in patient census, acuity etc. VA nurse executives are pleased with this methodology, but the top management team at the Milwaukee VAMC remains unconvinced of the staffing methodology's reliability and validity.

Milwaukee VAMC's top management team continues to identify too much subjectivity in this methodology that cannot be substantiated by objective, measurable data. The methodology continues to utilize the previous patient categories, which has demonstrated interrater-reliability issues. The unit manager's projection of staffing levels is based on subjectivity and not on

concrete, measurable data. The top management team acknowledges the advantages of flexibility in staffing, particularly in this volatile health care environment, but on the other hand, they raise valid questions to the flexible staffing.

Since fiscal year (FY) 1990 the acute care beds in the Medical Center have decreased from 543 beds to 324 beds (a decrease of 96 Medicine/Rehab/ Neuro beds, 82 Surgical beds, 23 Psychiatric beds and 18 Spinal Cord Injury beds). This decrease of 219 beds can be visualized in Graph 1.1.

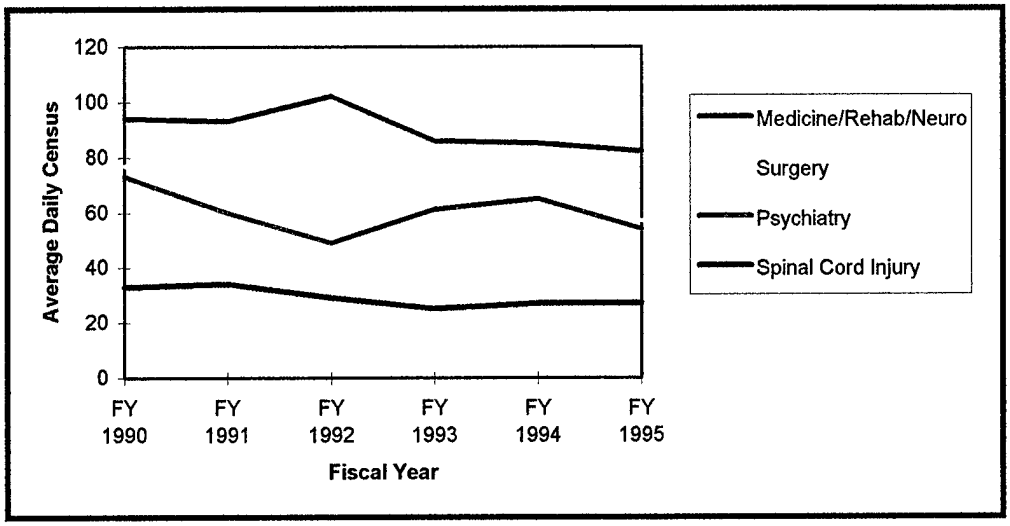
Graph 1.1
Acute Care Operating Beds




The top management team also notes that from 1990 to 1995 the average daily census (ADC) for acute care has decreased from 277 to 220, a decrease of 57

(refer to Graph 1.2). This decrease in ADC came from a reduction of 12 in Medicine/Rehab/Neuro, 20 in Surgery, 19 in Psychiatry and 6 in Spinal Cord Injury. Along with this decrease in acute care operating beds and ADC came the consolidation of six acute care units into three acute care units (4CN 4CS, 3AN 3AS, and 10AN 10AS) and the closure of two acute care units (6CN and 7AS).

Graph 1.2
Acute Care Average Daily Census




Management's third concern is the number of allocated nursing full time equivalents (FTEE). Since FY 1990, the acute care nurse staffing in the Medical Center has gone from 319.5 FTEE to 324.3 FTEE. This is an increase of 4.8 FTEE in acute inpatient care, as seen in Table 1.1.

Table 1.1
Acute Care Nursing FTEE

| Area | 1990 | 1993 | 1995 | Variance (1990-1995) |
|---|---|---|---|---|
| Medicine/Rehab/Neuro | 129.6 | 143.2 | 138.2 | 8.6 |
| Surgery | 99.6 | 111.3 | 105.6 | 6.0 |
| Psychiatry | 59.0 | 49.4 | 44.2 | -14.8 |
| Spinal Cord Injury | 31.3 | 37.3 | 36.3 | 5.0 |
| **Total** | **319.5** | **341.2** | **324.3** | **4.8** |

Data was obtained from previous organizational charts and does not include increases in advanced practice nurses, education, research, IV team ,or any other indirect FTEE in acute care. The data is only reflective of inpatient acute care.

Milwaukee VAMC's top management team is baffled by the facts: we have decreased beds, consolidated units, closed units, and decreased average daily census, yet we have increased nurse staffing levels in all the acute care areas except for Psychiatry.

Nurse executives defend the increased patient nurse staffing ratios with the increased acuity of the patients. They contend that since we have shortened patient's length of stay, the acuity of the patients has increased. However, nurse executives are unable to provide the top management team with concrete data to validate the nursing hours required to meet the needs of the VAMC's patients.

Another unresolved nurse staffing issue is the appropriate mix of nursing personnel. This Medical Center currently staffs each unit with a combined nursing staff of registered nurses, licensed practical nurses, and nursing assistants.

Nurse executives have been unable to provide measurable data to support the current levels for each type of nursing employee.

While the top management team is concerned with providing quality patient care and meeting the needs of the veteran patients, they are searching for methods to determine the most cost effective way of providing this care. Currently, they are not convinced the Expert Panel-Based Methodology is providing them with data to make informed decisions. They are seeking an objective, measurable method of determining the most cost effective nurse staffing levels to meet the patient care needs of this veteran population.

## *Statement of the Problem*

Health care executives must be able to accurately determine the appropriate number and mix of nursing personnel required to provide quality patient care in the most cost effective manner. Milwaukee VAMC's top management team does not have confidence in the current nurse staffing methodology. The current methodology is based on subjective data and fails to relate the staffing equation to measurable data. Therefore, it is necessary to present top management with an objective and measurable tool that will define a nurse staffing strategy capable of achieving optimal utilization of nursing

resources by matching the needs of the unit with the capabilities of the nursing staff.

## *Literature Review*

### Issues Relevant to Nurse Staffing

Health care executives need to be cautious when making adjustments to nursing staffing. These adjustments need to be supported by objective and measurable data while maintaining quality patient care. Recently, numerous interest groups have been questioning reductions in nurse staffing. Principally, these interest groups are questioning the basis for nurse staffing reductions.

The American Nurses Association (ANA) is an example of one interest group concerned with reduced nurse staffing levels. The ANA is lobbying for public accountability of hospitals for nurse staffing levels and mixes, including public disclosure of staffing and outcome data to consumers, insurers and federal state agencies (American Nurses Association, 1996). The American Association of Colleges of Nursing (AACN) has voiced concern that decisions to reduce nurse staffing level are not based on the appropriate, safe, and effective use of personnel, but are rather based on short-sighted solutions to contain costs (American Association of Colleges of Nursing, 1996).

Another group looking into nurse staffing is the Institute of Medicine (IOM) of the National Academy of Sciences. The IOM evaluated the adequacy of nursing care in hospitals and nursing homes. They documented a concern that hospitals are engaging in broad scale restructuring and changes in staffing patterns without adequately monitoring or evaluating the impact of staffing reallocations on patient outcomes (Institute of Medicine, 1996). These interest groups bring up important issues requiring consideration when determining nurse staffing. However, it is interesting to note that the typical acuity based staffing methodologies have not proven to be an effective tool in defending increases or decreases in nurse staffing nor have they addressed any of the concerns of these interest groups.

Nurse executives use patient acuity, severity of illness, and age as rationale for increased nurse staffing. Patient severity has not been quantified into reliable data and health care administrators continue to disbelieve this theory. A study was done on the impact of patients' severity of illness and age on nursing work load. The study found that the age of the patient did not predict the amount of nursing resources needed. The elderly may require considerable nursing resources, but they do so because they are ill and not merely because of their age. The authors state, "The real needs of patients must be known in order to determine the required level and mix of nursing activity" (Mion, McLaren, &

Frengley, 1988). Eric Helt and Richard Jelinek did a study on nursing productivity and the quality of patient care. During this study they found that even though the average length of stay dropped from 9.2 to 7.3 days and patient acuity rose approximately 10 percent, fewer nursing hours were used to care for the patients and remarkably quality also improved (Helt & Jelinek, 1988). These studies question nurse executives' arguments of patient acuity, severity of illness and age to justify nurse staffing levels.

Nurse staffing is an extremely complex process involving a variety of variables that are not easily measurable. Some believe the challenge of nurse staffing lies in determining the relationship between staffing and quality of care issues. The IOM report identifies a problem in isolating the factors involved in producing improved patient outcomes (Institute of Medicine, 1996). One recommendation from the IOM is to have "hospital management monitor and evaluate the effects of changes in organizational redesign and reconfiguration of nursing personnel on patient outcomes, patient satisfaction, and nursing personnel themselves" (Institute of Medicine, 1996 pg. 105). The ANA is lobbying for nursing report cards in the acute care setting (Lewin - VHI, Inc., 1996 pg. 17). They want to focus on Acute Care Nursing Quality Indicators. These indicators are divided into three different categories: patient-focused outcome indicators, process of care indicators, and structure of care indicators-nurse staffing patterns.

Specific examples in each category are outlined in Attachment A. While it is important to incorporate outcomes in staffing determinations, the AACN and the IOM Committee also encourage health care administrators to involve nursing personnel, who are directly affected by work redesign and staffing pattern, in any nurse staffing reorganization plan ( Institute of Medicine, 1996) and (Lewin - VHI, Inc., 1996).

Another important concept to integrate in any nurse staffing methodology is the Joint Commission for Accreditation of Health Care Organizations (JCAHO) standards. The 1996 JCAHO standard LD.2.4 states, "Directors recommend a sufficient number of qualified and competent persons to provide care" (Joint Commission on Accreditation of Healthcare Organizations, 1995 pg. 299). The intent of this standard is for department leaders to determine and keep administration informed on required resources to ensure adequate staffing and meet patients' needs. Additionally, standard HR.2 states, "The hospital provides an adequate number of staff members whose qualifications are consistent with job responsibilities" (Joint Commission on Accreditation of Healthcare Organizations, 1995 pg. 387). The intent of this standard is to provide experienced and trained staff in adequate numbers to serve and fulfill the department's part of the overall hospital's mission. Examples of performance for both of these staffing standards would be department specific staffing plans

outlining the specific number of staff required to provide care for a stated workload, i.e., how many registered nurses (RNs), licensed practical nurses (LPNs), and nursing assistants (NAs) are required to staff each unit for a given number or category of patients (Joint Commission on Accreditation of Healthcare Organizations, 1995). The current VA staffing methodology meets these JCAHO standards, however, it lacks objective data to support the appropriate mix and level of nursing personnel.

Many interest groups have expressed concerns and identified recommendations or standards for nurse staffing. These interest groups range from nursing employees, nursing leaders, nursing associations, accrediting bodies, and patients. It is important to understand and integrate the viewpoints/issues of these interest groups when determining nurse staffing levels..

Current Nurse Staffing Methodologies

The majority of nurse staffing methodologies rely on patient acuity or classification systems. Nagaprasanna performed a survey of hospitals and their use of patient classification and nurse staffing methodologies. The survey documented that 62% of the hospitals had been using a patient classification in conjunction with their nurse staffing methodology system for several years, but

they were dissatisfied with it. Specifically, they questioned the reliability and validity of the patient classification system (Nagaprasanna, 1988).

A maternity unit at Bristol Hospital displayed dissatisfaction with their patient classification system. They found the patient classification system yielded few results in determining staffing needs (Duclos-Miller, 1996). Van Slyck concluded that there are opportunities to carry out a more cost effective nursing service delivery, but he does not think it can be approached from the inherent design of a patient classification system. He argues, "By design, traditional classification systems are predictive in nature and the criteria are often vague and not universally applied across nursing units" (Van Slyck, 1991). The literature suggests that the traditional patient classification system is an inappropriate way to determine nurse staffing.

Attempts have been made to allocate nursing resources based solely on forecasted admissions, however, projected patient census alone has proven to be an ineffective staffing methodology. The Northern California Region of the Kaiser Permanete Medical Care Program is a good example of this. They found that the number of deliveries was not a relevant unit of service for the allocation of nursing resources in their labor and delivery units. They then developed a service unit model to allocate nursing resources which takes into account the nursing effort it takes to care for labor and delivery patients, the variability and

unpredictability of their needs, and the medical practice of the specific unit (Jones, Famularo, Desta, Fulgencio, & Rotondo, 1992). They found it necessary to utilize a nurse staffing allocation methodology that accounts for variability and the specific health care delivery model utilized on each unit. The advantages of this model are that it takes into consideration variability of patient flow and also accounts for the nursing care delivery specific to that unit. The disadvantage of this model is that the appropriate mix of nursing personnel has not been identified to achieve the most cost effective care for the unit.

Another frequently utilized staffing methodology is based on nursing hours per patient days. St. Joseph's Hospital, located in a suburb of Atlanta, Georgia, has a unit staffing plan based on hours per patient days. Each unit determines the average amount of nursing hours required to care for their specific patients. The number of nursing hours on a cardiology unit was measured and determined to be 9.44 hours per patient days and the nurse/patient ratio ranged from 5:1 to 6:1 (Brannon, Guyton, & Tyson, 1993). The advantage of this staffing methodology is the quantifiable data supporting the required hours of nursing hours per patient days. The weakness in this model is that it does not define the required hours for ancillary personnel and it does not provide quantifiable data for the appropriate mix of nursing personnel.

The current Expert Panel-Based Methodology utilized at the Milwaukee VAMC has documented disadvantages. The disadvantages include: overestimation of the need for nursing staff and problems with consistency of application and technique. VA nurse executives found literature supporting the importance of patient classification systems in identifying homogeneous groups of patients, but they acknowledge the limitations of work sampling methodologies in capturing the interactive processes of care, complexity of decision making, and overall integrative functions of nursing care (Dunn, et al., 1995).

While a number of methods are in existence to determine nurse staffing levels, none of them are based on unit specific, quantifiable data that determines the appropriate staffing level for each category of nursing employees. Health care administrators continue to question the reliability and validity of the current staffing methodologies because of the subjectivity involved. As the largest user of personnel, nursing must be able to justify its needs, productivity, and staff expenses. An objective, measurable methodology would be a valuable tool to determine nurse staffing needs.

Computer Simulation: Defined

Computer simulation can provide an interesting alternative in determining nurse staffing. It is a computerized tool used to simulate a detailed scale model

of a system, which imitates events occurring within the system. The goal of computer simulation is to simulate operations of real world systems (Law & Kelton, 1991). Computer simulation, if done correctly, can imitate the events occurring on a specific nursing unit and provide a pictorial representation of how the unit behaves and identify what factors represent real performance indicators (Keller, Harrell, & Leavy, 1991).

Simulation is unique because it not only provides the opportunity to view a dynamic system on the computer, but it also can provide insights in ways traditional methods of analysis cannot. Simulation has the ability to quickly generate a number of "what if" scenarios without costly capital and operating investments (Zilm, Arch, & Hollis, 1983). Once a nursing unit is modeled, a variety of variables can be altered and the effects of these changes can then be evaluated. An example of this on a nursing unit would be to vary the mix and amount of nursing personnel and then identify the most valuable use of these resources by evaluating idle time and utilized time for each category of nursing employee.

Although simulation has many advantages, it is not without weaknesses. Failures in simulation occur for three reasons: salesmanship, education, and time (Keller, et al., 1991). Salesmanship deals with selling the concept of the simulation package and the results it can achieve. Change and new products

typically bring about resistance and skepticism. Many nursing leaders do not believe an industrial engineering approach can be utilized in the complex health care environment. The seasoned simulator should be able to educate concerned individuals on the advantages of simulation modeling and provide them with examples. Involving individuals who work in the system being modeled in the data collection and simulation process will educate and encourage their vested interest in the project, hence, its results. Another important component in simulation is the educational level of the simulator. An advanced degree is not required to simulate a system, but there are certain skills one must possess to simulate successfully. This knowledge is easily obtainable via classes or simply working with a simulation package. Once this basic knowledge is achieved, simulation is a rewarding adventure. However, there is no such thing as simple simulation.

Like any tool of a similar nature, simulation can be intensely time consuming (Keller, et al., 1991). Programming the simulation package, identifying the variables to be measured, and collecting the data are very time consuming events. If enough time is allocated to the entire process, then an excellent product will be produced. When short cuts are endorsed and/or tasks are grouped together a less than satisfactory product will be achieved. Simulation is an effective modeling tool as long as simulators are able to sell the

concept of computer simulation; have a basic knowledge of simulation; and allow enough time to identify the variables, collect the pertinent data, and simulate the entire system.

Computer Simulation in Health Care

Simulation analysis has been used for an extended period of time in manufacturing and is becoming more evident in the health care environment. Recently, computer simulation has been utilized by researchers to investigate various aspects of hospital operations (Levy, Watford, & Owen, 1989). Specifically, simulation modeling has been used in health care to investigate the relationship between system configuration, patient flows, waiting times, and resource allocation (Cohen, Hershey, & Weiss, 1980).

Using computer simulation, a study was done in an Osteopathic Medical Center in Philadelphia to examine staffing requirements and evaluate work flow of a new diagnostic center. The study was done to determine the levels of staffing needed to provide care in a timely fashion. The researchers decided to use computer simulation for this system because computer simulation enabled them to model the system in a computer and try "what if" scenarios to test alternative design approaches. The researchers utilized a discrete simulation model. Discrete models are event driven and not clock driven as in continuous models.

A big challenge the researchers encountered was to correctly identify the events in order to collect the data of interest. When the computer simulation was completed, researchers provided management with a master schedule reflecting the appropriate staffing levels needed for the outpatient diagnostic center and changes in the layout of the clinic to achieve optimal efficiency. The study took almost four weeks to complete. Three weeks were spent on collecting statistics and three days were spent on building the model. While computer simulation offered the researchers the ability to vary the amount of staff at each area of the clinic; identify long waiting times and bottlenecks; and try "what if" scenarios, the disadvantage to this simulation approach was the time invested in accurately collecting data and modeling the clinic ( Wilt & Goddin, 1989).

Wolf, Gabriel, and Omachonu identified concerns with the current way their intensive care unit was projecting nurse staffing. In order to staff the intensive care unit effectively and meet the desired level of care, an acceptable number of RNs was required. The researchers needed to identify a more effective tool to project the most cost efficient number of nursing personnel to provide care to the patients in this intensive care unit. They decided to use computer simulation as a staffing tool, since a similar study found simulation to be the best method for considering the efficacy of various staffing alternatives (Duraiswamy, Welton, & Reisman, 1981). The researchers found they can use this model to

ask "what if" questions to determine predictable outcomes. This intensive care unit was staffing according to acuity level. However, many nurses did not take the time to fill out acuity forms adequately because they considered them to be nothing more than additional paperwork, which consumed inordinate amounts of time. Thus, the acuity based staffing methodology became an inadequate staffing tool. The researchers combined forecasted census with computer simulation modeling and provided management with something more than a "seat-of-the pants" approach to staffing. This model identified how many nurses were required to take care of a given number of patients. The flexibility of simulation modeling, in evaluating "what if" type of questions, was a distinct advantage to identify staffing needs in this intensive care unit (Wolf, Gabriel, & Omachonu, 1992).

Sandridge, Pritsker, and Delcher modeled a primary care clinic. They established three objectives: (1) To evaluate the need for additional providers of primary health care, (2) To gather and summarize current data, and (3) To assess polices which would affect the need for additional providers of primary care. The inclusion of provider and population characteristics as well as the modeling of the medical education of physicians required considerable detail. Therefore, simulation was chosen as the modeling tool. The researchers looked at specific performance measures that described how well the primary care health

providers were meeting demands, how many additional primary care providers were needed, and how changes in physician characteristics would affect the system. When the model was completed, the researchers were able to provide clinic managers with a number of scenarios. The scenarios varied with the type of health care providers, the characteristics of the physicians, the supply of physicians, and the demand for primary care. These scenarios were invaluable to clinic managers in projecting and meeting demand for primary care. The researchers found the data collection for model parameters and the definition of performance measures were time consuming tasks. Additionally, they identified the team effort of the physicians and the researchers to be an asset in modeling this primary care clinic (Sandridge, Pritsker, & Delcher, 1978).

Computer simulation is beginning to be utilized more frequently in the health care setting. As indicated earlier, nursing staffing is a complex process involving many variables. Computer simulation provides an alternative to the subjective nurse staffing methodologies currently in use. Data collection, although a time consuming computer simulation process, provides an objective measure of nursing work load. Bodinsky agrees that time studies involving work sampling and continuous observances of direct patient hours are a good way to determine nurse work load. However, she admits that it is a time consuming task (Bodinsky, 1993).

Traditional nurse staffing methodologies are typically based on acuity levels and incorporate subjective judgments. Arbitman argues that the nurse staffing process should avoid subjective judgments. Objectivity is important and nurse staffing must be free of bias due to individual judgment (Arbitman, 1986). Computer simulation provides a means to replicate the real life situation of a specific nursing unit and determines appropriate nurse staffing levels based on objective data.

## *Purpose of the Study*

The purpose of this research project is to determine the most cost effective nurse staffing mix on a specific acute care unit at the Milwaukee VAMC. The unit selected for this project is 5CN, a cardiac telemetry unit. This particular unit has a nursing staff that includes: registered nurses (RNs), licensed practical nurses (LPNs) and nursing assistants (NAs). The appropriate number of RNs, LPNs and NAs will be identified for a given number of patients on each shift. These numbers will be determined by taking into consideration the philosophy of the Milwaukee VAMC, the specific nursing philosophy of 5CN, non-patient care nursing activities, and patient needs/nursing work load needed to achieve identified patient outcomes.

# CHAPTER 2

# METHODS AND PROCEDURES

## *Computer Simulation*

MedModel, version 3.01, a health care simulation software package produced by the ProModel Corporation, was utilized to determine the appropriate number of nursing personnel on this cardiac telemetry unit. MedModel is a discrete, windows based program designed to simulate and analyze a variety of health care systems (ProModel Corporation, 1996). A computer assisted design (CAD) diagram of 5CN was imported into MedModel. This assured an accurate picture of the unit. The next step in the process was to identify patient outcomes, specific to 5CN.

### Patient Outcomes

As noted in the literature review, defining patient outcomes is important in determining nurse staffing. Patient outcomes should coincide with the nursing philosophy of the unit. The nursing staff and management of 5CN were actively involved in identifying the specific patient outcomes for this unit. The employees who manage and provide care to the patients on 5CN are the most qualified

individuals to define unit specific patient outcomes. Defining specific patient outcomes ultimately drives the health care needs of the veterans on this unit and meets the needs of many interest groups including the Joint Commission on Accreditation of Healthcare Organizations. The identified patient outcomes included: patient education, patient and family satisfaction, and minimal readmission rates. In order to achieve these outcomes a variety of variables directly related to these patient outcomes, needed to be identified, measured, and simulated.

Variables

Once again, the management and nursing staff of 5CN were directly involved in identifying variables included in the simulation of patient care activities, non-patient care activities, and other nursing workload for this unit. Examples of these variables are: average daily census, discharges, admissions, patient teaching, treatments, charting, telephone calls, interactions with interdisciplinary health team members, vital signs, medication administration, patient assessments, etc. Each of the identified variables requiring time studies were collected by the researcher. Retrospective data was utilized to determine the appropriate number of admissions, discharges, transfers onto the unit, transfers off the unit, surgeries, and cardiac catheterizations. The measurements of each

variable were then placed in a statistical package, Stat::Fit, to identify the most appropriate distribution. These measurements, distributions, and associated equations were then incorporated into the programming of the model. The next step in the process was to identify the competencies of each type of nursing employee.

Competencies of Each Type of Nursing Employee

To determine the most cost effective mix of nursing personnel, it was essential to identify the competencies for each category of nursing employee (i.e., the capabilities or tasks the RN, LPN, and NA can perform). This was determined by referring to the job descriptions of each category of nursing employee and verifying this information with the manager of 5CN. Once these competencies were determined, the model was then programmed to initially call the nursing employee with the lowest educational level capable of providing the required care. If the first identified category of nursing personnel was busy, then the computer called the next higher educated level nursing employee to respond to the health care need. This logic allowed the higher educated nursing employees to spend their time on health care tasks other nursing employees were unable to perform. This type of logic provided us with the most cost effective staffing mix for 5CN.

Hours of Operation

Due to the complexity of this model, nurse staffing determinations were limited to Sunday through Saturday on the day shift. The nurse staffing determinations were further limited to the staffing requirements for the average census. Simulation beyond this research project can be performed to include nurse staffing for variances from the average census on the day shift and expand it even further to include the second and third shifts.

## *Ethical Considerations*

Since the measurement of data was not associated with individual patients or employees, consent forms were not be required. The simulation system was discussed with the top management team at the Milwaukee VAMC, the administrative team of 5CN, and the nursing staff of 5CN.

## *Validity of the Simulation Model*

It is impossible to prove absolute validity of a simulation model. The goal was to achieve "face" validity. Face validity means, "From all outward indications, the model appears to be an accurate representation of the system" (ProModel Corporation, 1996, pg. 63). Face validity was initially achieved by allowing the nursing staff to be actively involved in the identification of variables

that need to be included in the simulation. Once the entire 5CN nursing unit was simulated, the administration and nursing staff viewed the model and determined that the animation was a fairly accurate reflection of the unit. There were some nursing duties the researcher could not capture and the nursing staff identified some patient care activities in the simulation that are often combined in the "real world." Examples of items not captured in the simulation include: picking up spills on the floor, obtaining missing medications, stocking modules, ordering supplies, and emergency situations. The nursing staff identified that nurse staff utilization would be decreased if the simulation combined some of the nursing duties i.e., the nursing employee giving the bath typically weighs the patient and if this nursing employee is an RN an assessment would be performed. The researcher and the nursing staff determined that time savings achieved from combining patient care activities would almost compensate for the items not captured in the simulation.

# CHAPTER 3

# THE DATA COLLECTION PROCESS

The nursing unit selected for this study was 5CN. This unit was restructured from a medical cardiac telemetry unit into a cardiac and cardiac surgery telemetry unit on August 1 of 1996. Therefore, it was not possible to use any data prior to August 1 1996. Due to renovation of other nursing units, 5CN received extra patients from these units during the months of November - December of 1996 and January of 1997. In an effort to make an accurate depiction of 5CN, data from November 1996 - January 1997 were also not used. The actual time studies began in February 1997. Retrospective data for admissions, discharges, transfers onto the unit, transfer off the unit, surgeries, and cardiac catheterizations were analyzed for the months of August - October 1996 and February - March 1997.

The major activities of 5CN were associated with the flow of patients in and out of the unit. Data for admissions, discharges, transfers off the unit, transfers onto the unit, cardiac catheterization patients, and surgical patients are outlined in Tables 3.1 - 3.7.

Table 3.1 Admissions to 5CN

| | Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|---|
| Days | 0.95 | 2.45 | 1.95 | 1.95 | 2.24 | 1.24 | 0.67 |
| Evenings | 0.52 | 0.59 | 0.73 | 0.68 | 0.76 | 0.80 | 0.25 |
| Nights | 0.05 | 0.09 | 0.09 | 0.14 | 0.00 | 0.05 | 0.19 |

Note: This is an average for the months of August-October 1996 and February-March 1997

Table 3.2 Discharges Off 5CN

| | Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|---|
| Days | 1.81 | 1.86 | 1.55 | 1.23 | 2.48 | 2.86 | 2.57 |
| Evenings | 0.43 | 0.18 | 0.55 | 0.77 | 0.86 | 1.48 | 0.48 |
| Nights | 0.00 | 0.00 | 0.09 | 0.14 | 0.19 | 0.10 | 0.10 |

Note: This is an average for the months of August-October 1996 and February-March 1997

Table 3.3 Transfers Onto 5CN

| | Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|---|
| Days | 0.68 | 0.77 | 0.77 | 1.19 | 1.32 | 1.10 | 1.10 |
| Evenings | 0.05 | 0.23 | 0.33 | 0.67 | 0.81 | 0.57 | 0.23 |
| Nights | 0.05 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.09 |

Note: Data based on the months of August-October 1996 and February-March 1997

Table 3.4 Transfers Off 5CN

| | Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|---|
| Days | 0.08 | 0.08 | 0.46 | 0.54 | 0.14 | 0.31 | 0.33 |
| Evenings | 0.08 | 0.31 | 1.08 | 0.31 | 0.64 | 0.69 | 0.08 |
| Nights | 0.00 | 0.08 | 0.00 | 0.00 | 0.14 | 0.00 | 0.08 |

Note: Data Based on the months of August-October 1996 and February-March 1997

Table 3.5 COTC Patients To 5CN
(Cardiac Catheterization Patients not admitted to 5CN)

| | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| **Average** | **0.44** | **1.00** | **1.00** | **1.56** | **0.78** |

Note: Data based on the months of February-April 1997
No COTC Patients were seen on Saturday or Sunday

Table 3.6 Cardiac Catheterization Patients On 5CN

| | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| **Average** | **1.9** | **0.9** | **1.7** | **1.4** | **1.6** |

Note: Data Based on the months of February-April 1997
Cardiac Catheterizations were not done on Saturday or Sunday

Table 3.7 Scheduled Surgical Patients On 5CN

| | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| Mean | 0.83 | 2.00 | 1.75 | 1.08 | 0.67 |
| Percentage of Patients not Returning to 5CN | 60% | 63% | 57% | 54% | 63% |

Note: Data based on the months of February-April 1997
There were no scheduled surgical patients on Saturday or Sunday

These tables indicate the difference in activity from day to day and from shift to shift. All of these patients consume a large portion of nursing time. Admissions and transfers onto the unit take a large portion of nursing time because of the initial nursing assessment that needs to be performed along with

the required documentation and transcription of orders. Discharges are very time consuming because of the time allocated to the appropriate documentation, patient teaching, and discharge planning initiatives. Transfers off the unit are equally time consuming because of the transfer paperwork, patient teaching, and/or critical care required prior to the transfer.

Cardiac catheterization patients require much nursing time because of the pre-procedure teaching, pre-procedure documentation and medication. Additionally, cardiac catheterization patients require a large amount of time post-procedure due to the initial and intermittent nursing assessments and the monitoring of vital signs every fifteen minutes times four, then every thirty minutes times four, and finally every hour times four. Cardiac catheterization patients also require patient teaching post-procedure, transcription of orders, and monitoring of intravenous fluids.

Coordinated outpatient testing center (COTC) patients admitted to this unit are cardiac catheterization patients who have not been admitted to 5CN prior to their procedure. Theses patients do not require the pre-procedure time of the nursing staff on 5CN, but they consume the same amount of post-procedure time as the cardiac catheterization patient..

Another category of patients consuming a large portion of nursing time is the surgical patients. Approximately 50 percent of the post surgical patients

return to 5CN. These post-operative patients require frequent monitoring similar to the post-cardiac catheterization patients and frequently require even more nursing time due to special drains, catheters, and special needs of the post-surgical patients.

While observing and collecting data on 5CN, it was evident that the above patient activities and flows created a heavy nursing workload, which varied from day to day and from shift to shift. Observation also indicated that nursing workload was related to patient teaching, patient assessment, and discharge planning. Since these items were directly related to the identified patient outcomes it was important to integrate these activities into the simulation model accurately.

During the data collection process the researcher collected minimal or inaccurate data on patient teaching and patient assessments. This occurred due to the heavy workload and past practices of the unit. Because the model needed to simulate 5CN as it should be and not the way it was currently being done, the collected data for these variables was useless. After discussion with the management of 5CN and clinical specialists, time frames were identified and agreed upon for these activities.

Routine patient care activities consuming a large amount of nursing time included vital signs, non-intravenous medications, intravenous medications, as

needed (prn) medications, weights, treatments, baths, bed making, patient procedures/tests, physical therapy appointments, intake and outputs, ringing call bells, patient care needs, and finger sticks. The distribution of patients receiving these patient care activities are listed in Tables 3.8 to 3.18.

Table 3.8 Non-IV Medication Administration

| Patients | 1:00 | 5:00 | 6:00 | 7:00 | 9:00 | 11:00 | 12:00 | |
|---|---|---|---|---|---|---|---|---|
| Percentage of Patients Receiving Medications | 10.62% | 60.18% | 5.31% | 37.17% | 94.69% | 40.71% | 13.27% | |
| | | | | | | | | |
| Patients | 13:00 | 14:00 | 16:30 | 17:00 | 18:00 | 20:00 | 21:00 | 23:00 |
| Percentage of Patients Receiving Medications | 70.80% | 3.54% | 9.73% | 74.34% | 9.73% | 5.31% | 89.38% | 37.17% |

Note: Data obtained from direct time studies during the months of February-March 1997

Table 3.9 PRN Medications

| | Nights | Days | Evenings |
|---|---|---|---|
| Percentage of Patients Receiving PRN Medications | 47.37% | 42.11% | 84.21% |
| Average PRNs per Patient | 1.30 | 1.44 | 1.56 |

Note: Data taken from direct observation during the months of February-March 1997

Table 3.10 Intravenous (IV) Mini Bag Administration

| | 1:00 | 5:00 | 9:00 | 11:00 | 13:00 | 17:00 | 21:00 | 23:00 |
|---|---|---|---|---|---|---|---|---|
| Percentage of Patients Receiving Mini Bags | 7.69% | 8.55% | 10.26% | 6.84% | 7.69% | 7.69% | 11.11% | 5.13% |
| Average Mini Bags per Patient | 1.00 | 1.00 | 1.33 | 1.13 | 1.00 | 1.11 | 1.08 | 1.00 |

Note: Data obtained from direct observation for the months of February-March 1997

Table 3.11 Procedures/Tests Performed On 5CN

| Day of the Week | Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|---|
| Percentage of Patients Going to Procedures/ Tests | 9.89% | 51.77% | 58.33% | 59.73% | 44.81% | 48.53% | 10.64% |

Note: Data obtained from direct observation during the months of February-March 1997

Table 3.12 Vital Signs

| Time | 1:00 | 5:00 | 9:00 | 11:00 | 13:00 | 17:00 | 21:00 | 23:00 |
|---|---|---|---|---|---|---|---|---|
| Percentage of Patients Requiring Vital Signs | 24.48% | 69.93% | 97.20% | 4.90% | 25.87% | 10.00% | 26.57% | 3.50% |

Note: Data obtained from direct observation during the months of February-March 1997

Table 3.13 Weights

| | Nights | Days | Evenings | None |
|---|---|---|---|---|
| Percent of Patients Having Weights | 25.42% | 6.78% | 51.69% | 16.10% |

Note: Data obtained from direct observation for the months of February-March 1997

Table 3.14 Frequency of Treatments

| | No RX | 1:00 | 5:00 | 9:00 | 13:00 | 18:00 | 21:00 |
|---|---|---|---|---|---|---|---|
| Average Number of Treatments per Patient | N/A | 1.03 | 1.12 | 1.37 | 1.06 | 1.22 | 1.03 |
| Percentage of Patients with or without Treatments | 58.73% | 25.40% | 29.37% | 53.17% | 28.57% | 39.68% | 27.78% |

Note: Data obtained from direct observation during the months of February-March 1997

Table 3.15 Physical Therapy Appointments at 10:00 and 14:30

| | Number of Appointments | Census | Percentage of Patients Having Physical Therapy Appointments |
|---|---|---|---|
| Total | 21 | 79 | 26.58% |

Note: Data obtained from direct observation during the months of February-March 1997

Table 3.16 Intake and Output

| | Yes | No |
|---|---|---|
| Percentage of Patients Requiring I/O's | 75.00% | 25.00% |

Note: Data obtained from direct observation during the months of February-March 1997

Table 3.17 Patient Call Bells

| Shift | Night | Day | Evening |
|---|---|---|---|
| Number of Calls per Patient | 0.67 | 1.67 | 1.00 |

Note: Data obtained from direct observation during the months of February-March 1997

Table 3.18 Finger Sticks

| Time | 5:00 | 11:00 | 17:00 | 21:00 |
|---|---|---|---|---|
| Percentage of Patients Requiring Finger Sticks | 20.74% | 16.30% | 18.52% | 14.07% |

Note: Data obtained from direct observation during the months of February-March 1997

It is important to know how many patients receive these patient care activities, but it is equally important to know how long each of these activities takes and even more important the appropriate distribution for these measurements. The measurements were obtained from direct measurement

during the time period of February to March 1997. The measurements for each activity were placed into a computer software package, Stat::Fit. This computer software then determined the most appropriate distribution for the measurements along with the appropriate formula that needed to be placed into the MedModel simulation program. The software was unable to determine a distribution for activities with less than ten measurements. Therefore, activities with less than ten measurements were appointed to the triangular distribution. The triangular distribution is a continuous distribution bounded on both sides and it is frequently used when little or no data is available. Listed in Table 3.19 is the appropriate distributions for a variety of patient care activities.

Table 3.19 Time Distributions for Patient Care Activities

| Patient Care Activity | Distribution |
|---|---|
| | |
| Non-IV Medications | Erlang |
| IV Mini Bags | Varied for each hour but the majority were Exponential |
| PRN Medications | Triangular |
| Finger Stick | Triangular |
| Total Bed Change | Weibull |
| Partial Bed Change | Triangular |
| Patient Call Lights | Weibull |
| Vital Signs | Log-Logistic |
| Standing Weight | Log-Logistic |
| Bed Scale Weight | Normal |
| Pre-Operative Prep | Triangular |
| Intake and Output | Beta |
| Total Bath | Triangular |
| Bath with Assistance | Triangular |
| Discharge Teaching | Triangular |
| Discharge Paperwork | Triangular |
| Getting a Room Ready | Triangular |
| ADL Sheets | Log-Logistic |
| Patient Care Items | Beta |
| Admission/Transfer Note | Triangular |
| Getting Patient Settled | Triangular |
| Transcribing Orders | Lognormal |
| Patient Assessments | Triangular |
| Treatments | Log-Logistic |

# CHAPTER 4

# The Simulation Process

The initial step in the simulation process was to import a computer CAD of the unit into the MedModel computer software package. This design of the unit was obtained from the Engineering Service. Once this diagram was intact, then a variety of different locations needed to be identified along with entities, pathways, and resources. Attachment B provides a depiction of the nursing unit.

The next step in the simulation process was to determine the flow of activities for the 5CN day shift. Table 4.20 illustrates the nursing workload flow for this active nursing unit on Tuesday.

Table 4.1 Time Line for Nursing Workload on 5CN's Tuesday-Day Shift

| Time | Nursing Workload |
|---|---|
| 7:30 AM | *** Patients arrive and are distributed to their rooms and assigned attributes**<br>*** Make out assignments**<br>*** Listen to report and review kardex at each module**<br>*** Print up assignment sheets**<br>*** Pre-op cardiac catheterization patient and the process continues when the patient returns post-procedure** |

| | |
|---|---|
| 8:00 AM | *** Count narcotics**<br>*** Breakfast trays are delivered, trays need to be set up and after 30 minutes the patient's dietary consumption is assessed along with documenting their intake if ordered**<br>*** Vital signs**<br>*** Patient assessments**<br>*** Telemetry check** |
| 9:00 AM | *** Patient baths, includes bath, bed making, and getting patient up in chair if appropriate**<br>*** Medication administration, includes routine medications and prn medications**<br>*** Intravenous mini bag administration**<br>*** Treatments**<br>*** Weights, bed scales only**<br>*** Start discharge for one patient**<br>*** Pre-op surgical patient** |
| 9:30 AM | *** Relieve telemetry person for break** |
| 10:00 AM | ***Prn medication administration**<br>*** Glucometer test**<br>*** Finger sticks**<br>*** First admission arrives**<br>*** Get patients ready for physical therapy and return them back to bed post-physical therapy.** |
| 10:30 AM | *** Pre-op second surgical patient** |

| | |
|---|---|
| 11:00 AM | *** Prn medication administration**<br>*** Routine medication administration**<br>*** Vital signs**<br>*** Intravenous mini bags** |
| 11:30 AM | *** Relieve telemetry person for lunch** |
| 12:00 PM | *** Second admission arrives**<br>*** Transfer Onto the unit arrives**<br>*** COTC patient arrives**<br>*** Routine medication administration**<br>*** Prn medication administration**<br>*** Trays are delivered which includes set up of trays and after 30 minutes the patient's dietary consumption is assessed and their intake recorded if ordered.** |
| 1:00 PM | *** Relieve telemetry person for break**<br>*** Medication administration, including routine medications and prns**<br>*** Vital signs**<br>*** Intravenous mini bag administration**<br>*** Treatments** |

| | |
|---|---|
| 2:00 PM | *** Get patients ready for physical therapy if appropriate and return them back to bed post-physical therapy**<br>*** Prn medication administration**<br>*** ADL sheets**<br>*** Total intake and output sheets for the day shift**<br>*** Fill out category work sheets at each module** |
| 3:00 PM | *** Fill out final work sheets for category**<br>*** Complete man hour report**<br>*** Tape report at each module**<br>*** Telemetry check** |
| 4:00 PM | *** Narcotic Count** |
| Continuous Arrivals Throughout the Day | *** Patient call bells**<br>*** Telephone calls**<br>*** Interactions with multidisciplinary health team members**<br>*** Orders**<br>*** Charting**<br>*** Patient Procedures** |

Once the flow chart was complete, it was imperative to conceptualize how the programming would be performed. While collecting data on 5CN and watching the nursing employees perform their jobs, the researcher realized the unit was attempting to provide nursing care through a primary care model. It was

the researchers option not to format into the simulation model with LPNs as part of the nurse staffing. This decision was made because the LPNs were providing nursing care to critically ill patients sometimes without having an RN evaluate the LPN's patients for the entire shift. Additionally, workload was distributed equally among the RNs and LPNs. This created staff dissatisfaction for the RNs, since the RNs needed to take off the LPNs orders, hang their intravenous mini bags, take verbal orders for the LPN's patients, and perform advanced assessments on the LPN's patients while maintaining their equal share of patients and workload. Since the LPNs were eliminated from nurse staffing, the researcher now was only dealing with RNs and NAs.

The third step in the process was challenging! Since the majority of activities were time based rather than entity or patient based, a creative approach needed to be taken in simulating this nursing unit. An array was set up to determine which patients would be receiving which patient care activities. In the array, the rows indicated specific patient care activities and the columns indicated the patient rooms. The array had 30 columns, relating to the 30 beds, 35 rows, relating to 35 patient care activities. Since the distributions changed with each simulation, the array was not standard. While a simulation is running a pictorial of that specific array can be visualized. An example of this array is documented in Attachment C. If the numbers were binomial then the zero (0) indicated the

bed was either vacant or the patient in the bed was not to receive the variable. If the number in the corresponding cell was one (1), in a binomial situation, then the patient received the variable. If the cells had numbers greater than one (1) then the zero (0) indicated that the patient did not receive the variable or the bed was vacant. The remaining numbers further defined the variable i.e., what type of bath the patient was to receive (a partial bath, a complete bath, or the patient was self care and able to perform their bath on their own accord). This array was an invaluable tool in the simulation processing logic.

In order to initiate the logic of the array, a time clock subroutine was introduced into the model. This clock initiated the majority of variables and as the entity went from bed to bed it was able to determine if the patient was to receive a variable or not. The clock subroutine is defined in Table 4.21.

Once the entity was ordered in the clock subroutine to show up at the nurses station, then processing logic needed to be developed so the entity would search for the patients requiring this entity. This process was done by having the entity search the array entitled kardex. The processing logic for the 9AM vital signs is outlined in Table 4.22. (Table 4.22 provides an explanation for the processing logic). If the entity moves onto an entity spot, a-destination-plus-30, then the processing logic at the entity spot directs how long the entity and

## Table 4.2 Processing Logic for the Clock Subroutine

```
int x=1
while x>0 do
begin while _min_var < 60 do
        begin wait 1 min
        inc(_min_var)
        end
inc(_hr_var)
        if _hr_var = 8 then order 1 tray_cart_1 to Nurses_Station1
        if _hr_var = 8 then order 1 Tray_cart_2 to Nurses_STation2
        if _hr_var = 8 then order 1 assessment_1 to Nurses_Station1
        if _hr_var = 8 then order 1 assessment_2 to Nurses_STation2
        if _hr_var = 9  then order 1 vital_sign_9_1_16 to Nurses_Station1
        if _hr_var = 9  then order 1 vital_sign_9_16_30 to Nurses_STation2
        if _hr_var = 9 then order 1 Medicine_9_1 to Nurses_Station1
        if _hr_var = 9 then order 1 Medicine_9_2 to Nurses_STation2
        if _hr_var = 9 then order 1 mini_bag_9a_1 to Nurses_Station1
        if _hr_var = 9 then order 1 mini_bag_9a_2 to Nurses_STation2
        if _hr_var = 9 then order 1 treatment_9_1 to Nurses_Station1
        if _hr_var = 9 then order 1 treatment_9_2 to Nurses_STation2
        if _hr_var = 9 then order 1 bath_1 to Nurses_Station1
        if _hr_var = 9 then order 1  bath_2 to Nurses_STation2
        if _hr_var = 10 then order 1 weight_1 to Nurses_Station1
        if _hr_var = 10 then order 1 weight_2 to Nurses_STation2
        if _hr_var = 10 then order 1 prn_10_1 to Nurses_Station1
        if _hr_var = 10 then order 1 prn_10_2 to Nurses_STation2
        if _hr_var = 10 then order 1 pt_1 to Nurses_Station1
        if _hr_var = 10 then order 1 pt_2 to Nurses_STation2
        if _hr_var = 10 then order 1 glucometer_1 to Nurses_Station1
        if _hr_var = 10 then order 1 glucometer_2 to Nurses_STation2
        if _hr_var = 11 then order 1 prn_11_1 to Nurses_Station1
        if _hr_var = 11 then order 1 prn_11_2 to Nurses_STation2
        if _hr_var = 11 then order 1 Medicine_11_1 to Nurses_Station1
        if _hr_var = 11 then order 1 Medicine_11_2 to Nurses_STation2
        if _hr_var = 11 then order 1 vital_sign_11_1 to Nurses_Station1
        if _hr_var = 11 then order 1 vital_sign_11_2 to Nurses_STation2
        if _hr_var = 11 then order 1 mini_bag_11a_1 to Nurses_Station1
        if _hr_var = 11 then order 1 mini_bag_11a_2 to Nurses_STation2
        if _hr_var = 12 then order 1 Medicine_12_1 to Nurses_Station1
        if _hr_var = 12 then order 1 Medicine_12_2 to Nurses_STation2
        if _hr_var = 12 then order 1 prn_12_1 to Nurses_Station1
        if _hr_var = 12 then order 1 prn_12_2 to Nurses_STation2
        if _hr_var = 13 then order 1 tray_cart_1 to Nurses_Station1
        if _hr_var = 13 then order 1 Tray_cart_2 to Nurses_STation2
        if _hr_var = 13 then order 1 Medicine_13_1 to Nurses_Station1
        if _hr_var = 13 then order 1 Medicine_13_2 to Nurses_STation2
        if _hr_var = 13 then order 1 vital_sign_13_1 to Nurses_Station1
        if _hr_var = 13 then order 1 vital_sign_13_2 to Nurses_STation2
        if _hr_var = 13 then order 1 mini_bag_13a_1 to Nurses_Station1
        if _hr_var = 13 then order 1 mini_bag_13a_2 to Nurses_STation2
        if _hr_var = 13 then order 1 treament_13_1 to Nurses_Station1
        if _hr_var = 13 then order 1 treatment_13_2 to Nurses_STation2
        if _hr_var = 14 then order 1 pt_1 to Nurses_Station1
        if _hr_var = 14 then order 1 pt_2 to Nurses_STation2
        if _hr_var = 14 then order 1 prn_14_1 to Nurses_Station1
        if _hr_var = 14 then order 1 prn_14_2 to Nurses_STation2
        if _hr_var = 14 then order 1 adl_1 to Nurses_Station1
        if _hr_var = 14 then order 1 adl_2 to Nurses_STation2
        if _hr_var = 14 then order 1 Intake_1 to Nurses_Station1
        if _hr_var = 14 then order 1 Intake_2 to Nurses_STation2
_min_var=0
if _hr_var=24 then _hr_var=0
end
```

Table 4.3 Processing Logic for 9AM Vital Signs at Nurses Station

| | Process | Rationale |
|---|---|---|
| Entity | 9AM Vital Sign | The entity ordered by the clock subroutine |
| Location | Nurses Station 1 | The vital sign entity is ordered to a specific location called nurses station |
| Operation | Get Nursing_assistant_1 OR Registered_Nurse_1 | When the entity arrived at the nurses station it is to get a resource |
| | Int row = 1<br>Int column = 1<br>Int content_of_cell | Local variables defined (referring to the array): row 1 (9AM vital signs), column 1 (the first bed on the unit), and content of cell, for further definition in the next step |
| | while column <17 do<br>begin | Refers to the array and if the column is less than 17 then begin the process. The reason for requesting the column to be less than 17 is that the nursing unit was divided into two sections. |
| | content_of_cell = kardex[row, column] | Indicates the local variable, content of cell, equals the number in the identified row and column of the array (the array is entitled kardex) |
| | If content_of_cell = 1 then<br>begin | Indicates that if the cell is equal to one to begin the process but if the content of the cell is zero then to go on to the next process |
| | a_destination_plus_30 = column + 30<br>column=17<br>route 1<br>end | An attribute is being set where a_destination_plus_30 is equal to the column plus 30. The first 30 locations identify each bed on the unit from the first bed to the last bed. The next 30 locations refer to the entity spot created, near each bed, for the entities to arrive. The entity spot needed to be created because each bed is limited to a capacity of one. Therefore, the destination for this entity is the entity spot associated with that specific bed |
| | else<br>Inc column<br>If column=17 then<br>Begin<br>free OWNEDRESOURCE()<br>Route 2<br>End | This new process indicates that if the content of cell equals zero then to go on to the next column. If the process continues to proceed to the seventeenth column then free the OWNEDRESOURCE(), which is the resource called in the first operation above, and take route 2, the exit. |
| Output | 9AM Vital Sign | The entity remains the same, 9AM vital sign |
| Destination | Route 1) Loc(a_destination+30)<br>Route 2) Exit | If the array has identified a cell (from column 1-16) that has a content of 1 then the entity must proceed to the associated entity spot. If the array has not identified any cells (from columns 1-16) with a content of 1 then the entity will exit |
| Move Logic | Move with OWNEDRESOURCE() | This is the resource that was initially called in the processing logic above |

**Table 4.4 Arrivals**

| Entity | Location | Quantity | First Time in Minutes |
|---|---|---|---|
| Patient | New | 19 | 0 |
| Pt Cardiac Catheterization | Call 1 | 1 | 30 |
| Pt COTC | Call 18 | 1 | 270 |
| Admission 1 | Bed Admission | 1 | 150 |
| Admission 2 | Bed Admission | 1 | 270 |
| Transfer In | Bed Transfer In | 1 | 300 |
| Discharge | Call 12 | 1 | 100 |
| Surgical Patient 1 | Call 16 | 1 | 60 |
| Surgical Patient 2 | Call 23 | 1 | 180 |
| Narcotic Count | Medication Room | 1 | 20 |
| Narcotic Count | Medication Room | 1 | 480 |
| Beginning Shift Report and Kardex 1 | Mod 1 | 1 | 5 |
| Beginning Shift Report and Kardex 2 | Mod 2 | 1 | 5 |
| Beginning Shift Report and Kardex 3 | Mod 3 | 1 | 5 |
| Beginning Shift Report and Kardex 4 | Mod 4 | 1 | 5 |
| End Shift Report 1 | Mod1 | 1 | 400 |
| End Shift Report 2 | Mod 2 | 1 | 400 |
| End Shift Report 3 | Mod 3 | 1 | 400 |
| End Shift Report 4 | Mod 4 | 1 | 400 |
| Class Worksheet 1 | Mod 1 | 1 | 300 |
| Class Worksheet 2 | Mod 2 | 1 | 300 |
| Class Worksheet 3 | Mod 3 | 1 | 300 |
| Class Worksheet 4 | Mod 4 | 1 | 300 |
| Telemetry Check 1 | Mod 1 | 1 | 30 |
| Telemetry Check 2 | Mod 2 | 1 | 30 |
| Telemetry Check 3 | Mod 3 | 1 | 30 |
| Telemetry Check 4 | Mod 4 | 1 | 30 |
| Telemetry Check 1 | Mod 1 | 1 | 330 |
| Telemetry Check 2 | Mod 2 | 1 | 330 |
| Telemetry Check 3 | Mod 3 | 1 | 330 |
| Telemetry Check 4 | Mod 4 | 1 | 330 |
| Morning Assignments | Telemetry Room | 1 | 1 |
| End Shift Final Report | Telemetry Room | 1 | 420 |

| Table 4.4 Continued | | | |
|---|---|---|---|
| **Entity** | **Location** | **Quantity** | **First Time in Minutes** |
| Interaction 1 | Mod 1 | P(10) | 0 |
| Interaction 2 | Mod 2 | P(10) | 0 |
| Interaction 3 | Mod 3 | P(10) | 0 |
| Interaction 4 | Mod 4 | P(10) | 0 |
| Telephone Call 1 | Mod 1 | P(8) | 20 |
| Telephone Call 2 | Mod 2 | P(8) | 20 |
| Telephone Call 3 | Mod 3 | P(8) | 20 |
| Telephone Call 4 | Mod 4 | P(8) | 20 |
| Patient Call Light 1 | Mod 1 | P(12) | 30 |
| Patient Call Light 2 | Mod 2 | P(12) | 30 |
| Patient Call Light 3 | Mod 3 | P(12) | 30 |
| Patient Call Light 4 | Mod 4 | P(12) | 30 |
| Telemetry Break | Telemetry Room | 1 | 110 |
| Telemetry Break | Telemetry Room | 1 | 390 |
| Telemetry Lunch | Telemetry Room | 1 | 240 |
| Order 1 | Nurses Station 1 | P(17) | 120 |
| Order 2 | Nurses Station 2 | P(17) | 120 |
| Chart 1 | Mod 1 | P(9) | 200 |
| Chart 2 | Mod 3 | P(9) | 200 |
| Patient Procedure 1 | Mod 2 | P(6) | 30 |
| Patient Procedure 2 | Mod 4 | P(6) | 60 |

resource need to stay to perform the patient care activity and then continue with similar processing logic outlined in Table 4.22. This logic will then either move the entity and the OWNEDRESOURCE to the next entity spot associated with a patient who needs that patient care activity or exit the system if not other patients are identified.

Although the majority of patient care and non-patient care variables were time based, utilizing the clock subroutine, some of the entities arrived through the arrival cycle. Table 4.23 identifies the arrival cycle for Tuesday's day shift. Since admissions, discharges, transfers onto the unit, transfers off the unit, cardiac catheterization patients, etc. changed from day to day, then the amount of these entities and arrival times changed from day to day.

The next step in the process was to identify a variety of shifts for the resources. All the nursing staff on 5CN were working eight hour shifts or part time shifts. Therefore, these work hours were simulated in the model. A variety of eight hour shifts were designed while varying the two fifteen minute breaks and the thirty minute lunch hours. Some part time four hour shifts, three hours shifts, and two hour shifts were also designed.

Once the model was "debugged", the researcher developed a model for each day of the week. Since the number of admissions, discharges, transfers onto the unit, transfers off the unit, surgeries, average census at the start of the shift, etc. varied from day to day; a separate model was developed for each day of the week.

The nurse staffing was then varied for each day of the week in order to achieve the optimal nurse staffing mix. This optimal nurse staffing level was determined by the highest percentage of nurse staff utilization near the $90^{th}$

percent level and the lowest number of entities still remaining in the system. The simulation model was run for fifty-two replications, to account for the variation in activity, and then the statistics for these replications were averages. Tables 4.24 - 4.30 outline some of these comparisons for each day of the week. While a number of different staffing scenarios were attempted for each day of the week only three scenarios are identified in the tables below. The highlighted rows indicated that these activities had greater than two entity arrivals during the eight hour simulation. The other activities had either one or two entity arrivals, with the majority being one.

# Table 4.5A Sunday - Activity Level and Resource Runs

| Activity | |
|---|---|
| Patients At 0700 | 16 |
| Admissions | 1 |
| Discharges | 2 |
| Transfers Onto Unit | 0 |
| Transfers Off Unit | 0 |
| Cardiac Catheterizations | 0 |
| COTC | 0 |
| Surgical Patients | 0 |
| Patients at 1600 | 15 |

**Run 1**

| Resource | % Utilization | Status |
|---|---|---|
| Nursing Assistant 1 | 88.49% | Part Time 0.5 |
| Nursing Assistant 2 | 88.20% | Part Time 0.5 |
| Registered Nurse 1.1 | 94.45% | Full Time |
| Registered Nurse 1.2 | 95.88% | Full Time |
| Registered Nurse 2.1 | 95.00% | Full Time |
| Registered Nurse 2.2 | 95.13% | Full Time |
| TOTAL FTEE | | **5.0 FTEE** |

**Run 2**

| Resource | % Utilization | Status |
|---|---|---|
| Nursing Assistant 1 | 79.49% | Full Time |
| Nursing Assistant 2 | 84.39% | Part Time 0.5 |
| Registered Nurse 1.1 | 94.15% | Full Time |
| Registered Nurse 1.2 | 94.19% | Full Time |
| Registered Nurse 2.1 | 90.49% | Full Time |
| Registered Nurse 2.2 | 90.18% | Full Time |
| TOTAL FTEE | | **5.5 FTEE** |

**Run 3**

| Resource | % Utilization | Status |
|---|---|---|
| Nursing Assistant 1 | 69.99% | Full Time |
| Nursing Assistant 2 | 70.24% | Full Time |
| Registered Nurse 1.1 | 88.42% | Full Time |
| Registered Nurse 1.2 | 89.34% | Full Time |
| Registered Nurse 2.1 | 85.78% | Full Time |
| Registered Nurse 2.2 | 86.23% | Full Time |
| TOTAL FTEE | | **6.0 FTEE** |

Table 4.5B Sunday - Remaining Entities After The Day Shift
(Average of 52 Replications)

| Entity | RUN 1 | RUN 2 | RUN 3 |
|---|---|---|---|
| ADL 1 | 0.53 | **0.36** | 0.25 |
| ADL 2 | 0.42 | **0.34** | 0.23 |
| Beginning Shift Report/Kardex 1 | 0.00 | **0.00** | 0.00 |
| Beginning Shift Report/Kardex 2 | 0.00 | **0.00** | 0.00 |
| Beginning Shift Report/Kardex 3 | 0.00 | **0.00** | 0.00 |
| Beginning Shift Report/Kardex 4 | 0.00 | **0.00** | 0.00 |
| Chart 1 | 1.63 | **0.13** | 1.07 |
| Chart 2 | 2.19 | **0.13** | 1.36 |
| Class Worksheet 1 | 0.05 | **0.19** | 0.09 |
| Class Worksheet 2 | 0.05 | **0.19** | 0.09 |
| Class Worksheet 3 | 0.15 | **0.40** | 0.09 |
| Class Worksheet 4 | 0.15 | **0.38** | 0.09 |
| Shift Final Report | 0.07 | **0.13** | 0.07 |
| End Shift Report/Kardex 1 | 0.07 | **0.13** | 0.07 |
| End Shift Report/Kardex 2 | 0.07 | **0.13** | 0.07 |
| End Shift Report/Kardex 3 | 0.11 | **0.15** | 0.09 |
| End Shift Report/Kardex 4 | 0.13 | **0.15** | 0.09 |
| Glucometer 1 | 0.11 | **0.15** | 0.11 |
| Glucometer 2 | 0.05 | **0.09** | 0.05 |
| Intake 1 | 0.07 | **0.11** | 0.07 |
| Intake 2 | 0.09 | **0.15** | 0.07 |
| Interaction 1 | 0.00 | **0.00** | 0.00 |
| Interaction 2 | 0.00 | **0.00** | 0.00 |
| Interaction 3 | 0.00 | **0.00** | 0.00 |
| Interaction 4 | 0.00 | **0.00** | 0.00 |
| Medicine 9-1 | 0.00 | **0.00** | 0.00 |
| Medicine 9-2 | 0.00 | **0.00** | 0.00 |
| Medicine 11-1 | 0.36 | **0.32** | 0.21 |
| Medicine 11-2 | 0.28 | **0.25** | 0.17 |
| Medicine 12-1 | 0.42 | **0.40** | 0.23 |
| Medicine 12-2 | 0.44 | **0.26** | 0.21 |
| Medicine 13-1 | 0.05 | **0.13** | 0.07 |
| Medicine 13-2 | 0.11 | **0.15** | 0.07 |
| Mini bag 9 | 0.40 | **0.19** | 0.19 |
| Mini bag 11 | 0.00 | **0.00** | 0.00 |
| Mini bag 13 | 0.73 | **0.51** | 0.30 |
| Morning Assignments | 0.00 | **0.00** | 0.00 |
| Narcotic Count | 0.15 | **0.17** | 0.11 |

| Table 4.5B (continued) | | | |
|---|---|---|---|
| Entity | RUN 1 | RUN 2 | RUN 3 |
| Order 1 | 0.82 | **1.30** | 0.82 |
| Order 2 | 0.46 | **1.05** | 0.76 |
| Patient Assessment 1 | 0.00 | **0.00** | 0.00 |
| Patient Assessment 2 | 0.00 | **0.00** | 0.00 |
| Patient In Chair 1 | 0.36 | **0.69** | 0.15 |
| Patient In Chair 2 | 0.53 | **0.28** | 0.19 |
| Patient Procedure 1 | 0.53 | **0.46** | 0.26 |
| Patient Procedure 2 | 0.69 | **0.38** | 0.23 |
| Patient Treatment 1 | 0.98 | **0.71** | 0.40 |
| Patient Treatment 2 | 1.09 | **0.82** | 0.50 |
| PRN 10-1 | 0.11 | **0.17** | 0.11 |
| PRN 10-2 | 0.07 | **0.11** | 0.05 |
| PRN 11-1 | 0.11 | **0.17** | 0.13 |
| PRN 11-2 | 0.21 | **0.25** | 0.17 |
| PRN 12-1 | 0.40 | **0.40** | 0.23 |
| PRN 12-2 | 0.44 | **0.26** | 0.21 |
| PRN 14-1 | 0.57 | **0.51** | 0.26 |
| PRN 14-2 | 0.59 | **0.36** | 0.23 |
| Patient Bath 1 | 0.51 | **0.50** | 0.23 |
| Patient Bath 2 | 0.30 | **0.46** | 0.09 |
| Patient Call 1 | 0.00 | **0.00** | 0.00 |
| Patient Call 2 | 0.00 | **0.00** | 0.00 |
| Patient Call 3 | 0.00 | **0.00** | 0.00 |
| Patient Call 4 | 0.00 | **0.00** | 0.00 |
| Telemetry Break | 0.69 | **0.53** | 0.23 |
| Telemetry Lunch | 0.26 | **0.23** | 0.13 |
| Telemetry Check 1 | 0.05 | **0.13** | 0.07 |
| Telemetry Check 2 | 0.05 | **0.13** | 0.07 |
| Telemetry Check 3 | 0.09 | **0.15** | 0.07 |
| Telemetry Check 4 | 0.09 | **0.15** | 0.07 |
| Telephone 1 | 0.00 | **0.00** | 0.00 |
| Telephone 2 | 0.00 | **0.00** | 0.00 |
| Telephone 3 | 0.00 | **0.00** | 0.00 |
| Telephone 4 | 0.00 | **0.00** | 0.00 |
| Tray 1 | 3.55 | **2.86** | 1.48 |
| Tray 2 | 3.98 | **2.86** | 1.69 |

| Table 4.5B (continued) | | | |
|---|---|---|---|
| Entity | RUN 1 | **RUN 2** | RUN 3 |
| Vital Sign 9-1 | 0.00 | **0.00** | 0.00 |
| Vital Sign 9-2 | 0.00 | **0.00** | 0.00 |
| Vital Sign 11-1 | 0.28 | **0.26** | 0.19 |
| Vital Sign 11-2 | 0.19 | **0.19** | 0.15 |
| Vital Sign 13-1 | 0.51 | **0.40** | 0.23 |
| Vital Sign 13-2 | 0.51 | **0.36** | 0.21 |
| Weight 1 | 0.44 | **0.32** | 0.19 |
| Weight 2 | 0.44 | **0.36** | 0.26 |

# Table 4.6A Monday - Activity Level and Resource Runs

| Activity | |
|---|---|
| Patients At 0700 | 17 |
| Admissions | 2 |
| Discharges | 2 |
| Transfers Onto Unit | 1 |
| Transfers Off Unit | 0 |
| Cardiac Catheterizations | 2 |
| COTC | 0 |
| Surgical Patients | 1 |
| Patients at 1600 | 18 |

**Run 1**

| Resource | % Utilization | Status |
|---|---|---|
| Nursing Assistant 1 | 85.17% | Full Time |
| Nursing Assistant 2 | 85.17% | Full Time |
| Registered Nurse 1.1 | 95.91% | Full Time |
| Registered Nurse 1.2 | 95.25% | Full Time |
| Registered Nurse 1.3 | 96.08% | Full Time |
| Registered Nurse 2.1 | 92.55% | Full Time |
| Registered Nurse 2.2 | 91.64% | Full Time |
| Registered Nurse 2.3 | 90.64% | Full Time |
| TOTAL FTEE | | **8.0 FTEE** |

**Run 2**

| Resource | % Utilization | Status |
|---|---|---|
| Nursing Assistant 1 | 82.68% | Full Time |
| Nursing Assistant 2 | 92.45% | Part Time 0.5 |
| Registered Nurse 1.1 | 94.37% | Full Time |
| Registered Nurse 1.2 | 94.58% | Full Time |
| Registered Nurse 1.3 | 94.30% | Full Time |
| Registered Nurse 2.1 | 95.88% | Full Time |
| Registered Nurse 2.2 | 94.81% | Full Time |
| Registered Nurse 2.3 | 94.92% | Full Time |
| TOTAL FTEE | | **7.5FTEE** |

**Run 3**

| Resource | % Utilization | Status |
|---|---|---|
| Nursing Assistant 1 | 87.85% | Full Time |
| Nursing Assistant 2 | 95.09% | Full Time |
| Registered Nurse 1.1 | 96.69% | Full Time |
| Registered Nurse 1.2 | 97.59% | Full Time |
| Registered Nurse 1.3 | 97.20% | Full Time |
| Registered Nurse 2.1 | 96.87% | Full Time |
| Registered Nurse 2.2 | 97.09% | Full Time |
| Registered Nurse 2.3 | 96.64% | Part Time 0.5 |
| TOTAL FTEE | | **7.5 FTEE** |

Table 4.6B Monday - Remaining Entities After The Day Shift
(Average of 52 Replications)

| Entity | RUN 1 | RUN 2 | RUN 3 |
|---|---|---|---|
| ADL 1 | 0.46 | **0.38** | 0.44 |
| ADL 2 | 0.44 | **0.38** | 0.59 |
| Beginning Shift Report/Kardex 1 | 0.00 | **0.00** | 0.00 |
| Beginning Shift Report/Kardex 2 | 0.00 | **0.00** | 0.00 |
| Beginning Shift Report/Kardex 3 | 0.00 | **0.00** | 0.00 |
| Beginning Shift Report/Kardex 4 | 0.00 | **0.00** | 0.00 |
| Chart 1 | 1.53 | **1.34** | 2.57 |
| Chart 2 | 1.59 | **1.65** | 2.73 |
| Class Worksheet 1 | 0.09 | **0.07** | 0.23 |
| Class Worksheet 2 | 0.09 | **0.07** | 0.23 |
| Class Worksheet 3 | 0.28 | **0.38** | 0.32 |
| Class Worksheet 4 | 0.28 | **0.38** | 0.32 |
| Shift Final Report | 0.11 | **0.05** | 0.25 |
| End Shift Report/Kardex 1 | 0.11 | **0.05** | 0.25 |
| End Shift Report/Kardex 2 | 0.11 | **0.05** | 0.25 |
| End Shift Report/Kardex 3 | 0.28 | **0.42** | 0.36 |
| End Shift Report/Kardex 4 | 0.28 | **0.42** | 0.36 |
| Glucometer 1 | 0.09 | **0.13** | 0.23 |
| Glucometer 2 | 0.11 | **0.17** | 0.21 |
| Intake 1 | 0.11 | **0.05** | 0.11 |
| Intake 2 | 0.28 | **0.30** | 0.34 |
| Interaction 1 | 0.00 | **0.00** | 0.00 |
| Interaction 2 | 0.00 | **0.00** | 0.00 |
| Interaction 3 | 0.00 | **0.00** | 0.00 |
| Interaction 4 | 0.00 | **0.00** | 0.00 |
| Medicine 9-1 | 0.00 | **0.00** | 0.13 |
| Medicine 9-2 | 0.00 | **0.01** | 0.03 |
| Medicine 11-1 | 0.26 | **0.25** | 0.40 |
| Medicine 11-2 | 0.28 | **0.32** | 0.40 |
| Medicine 12-1 | 0.28 | **0.26** | 0.42 |
| Medicine 12-2 | 0.30 | **0.38** | 0.51 |
| Medicine 13-1 | 0.09 | **0.05** | 0.23 |
| Medicine 13-2 | 0.28 | **0.36** | 0.34 |
| Mini bag 9 | 0.40 | **0.00** | 0.73 |
| Mini bag 11 | 0.00 | **0.00** | 0.00 |
| Mini bag 13 | 0.50 | **0.69** | 0.76 |
| Morning Assignments | 0.00 | **0.00** | 0.00 |
| Narcotic Count | 0.23 | **0.32** | 0.40 |

| Table 4.6B (continued) | | | |
|---|---|---|---|
| Entity | RUN 1 | RUN 2 | RUN 3 |
| Order 1 | 0.94 | **1.28** | 2.23 |
| Order 2 | 0.94 | **1.67** | 2.61 |
| Patient Assessment 1 | 0.00 | **0.00** | 1.09 |
| Patient Assessment 2 | 0.00 | **0.00** | 0.09 |
| Patient In Chair 1 | 0.42 | **0.44** | 0.42 |
| Patient In Chair 2 | 0.40 | **0.42** | 0.50 |
| Patient Procedure 1 | 0.98 | **0.84** | 1.42 |
| Patient Procedure 2 | 0.36 | **1.32** | 1.32 |
| Patient Treatment 1 | 0.82 | **0.78** | 1.42 |
| Patient Treatment 2 | 0.73 | **1.05** | 1.57 |
| PRN 10-1 | 0.09 | **0.11** | 0.23 |
| PRN 10-2 | 0.09 | **0.23** | 0.23 |
| PRN 11-1 | 0.09 | **0.13** | 0.25 |
| PRN 11-2 | 0.26 | **0.32** | 0.38 |
| PRN 12-1 | 0.28 | **0.26** | 0.42 |
| PRN 12-2 | 0.30 | **0.38** | 0.51 |
| PRN 14-1 | 0.44 | **0.36** | 0.51 |
| PRN 14-2 | 0.36 | **0.44** | 0.57 |
| Patient Bath 1 | 0.50 | **0.59** | 1.50 |
| Patient Bath 2 | 0.46 | **0.65** | 1.05 |
| Patient Call 1 | 0.00 | **0.00** | 0.00 |
| Patient Call 2 | 0.00 | **0.00** | 0.00 |
| Patient Call 3 | 0.00 | **0.00** | 0.00 |
| Patient Call 4 | 0.00 | **0.00** | 0.00 |
| Telemetry Break | 0.50 | **0.63** | 0.80 |
| Telemetry Lunch | 0.25 | **0.25** | 0.46 |
| Telemetry Check 1 | 0.09 | **0.05** | 0.23 |
| Telemetry Check 2 | 0.09 | **0.05** | 0.23 |
| Telemetry Check 3 | 0.28 | **0.36** | 0.34 |
| Telemetry Check 4 | 0.28 | **0.36** | 0.34 |
| Telephone 1 | 0.00 | **0.00** | 0.00 |
| Telephone 2 | 0.00 | **0.00** | 0.00 |
| Telephone 3 | 0.00 | **0.00** | 0.00 |
| Telephone 4 | 0.00 | **0.00** | 0.00 |
| Tray 1 | 2.96 | **2.75** | 4.71 |
| Tray 2 | 2.71 | **3.25** | 5.40 |

| Table 4.6B (continued) | | | |
|---|---|---|---|
| Entity | RUN 1 | **RUN 2** | RUN 3 |
| Vital Sign 9-1 | 0.00 | **0.00** | 0.15 |
| Vital Sign 9-2 | 0.00 | **0.00** | 0.00 |
| Vital Sign 11-1 | 0.23 | **0.23** | 0.36 |
| Vital Sign 11-2 | 0.26 | **0.30** | 0.40 |
| Vital Sign 13-1 | 0.38 | **0.34** | 0.46 |
| Vital Sign 13-2 | 0.36 | **0.40** | 0.61 |
| Weight 1 | 0.36 | **0.30** | 0.50 |
| Weight 2 | 0.30 | **0.28** | 0.57 |

# Table 4.7A Tuesday - Activity Level and Resource Runs

| Activity | |
|---|---|
| Patients At 0700 | 19 |
| Admissions | 2 |
| Discharges | 2 |
| Transfers Onto Unit | 1 |
| Transfers Off Unit | 0 |
| Cardiac Catheterizations | 1 |
| COTC | 1 |
| Surgical Patients | 2 |
| Patients at 1600 | 21 |

**Run 1**

| Resource | % Utilization | Status |
|---|---|---|
| Nursing Assistant 1 | 87.94% | Full Time |
| Nursing Assistant 2 | 89.09% | Full Time |
| Registered Nurse 1.1 | 98.04% | Full Time |
| Registered Nurse 1.2 | 97.96% | Full Time |
| Registered Nurse 1.3 | 98.26% | Full Time |
| Registered Nurse 2.1 | 94.46% | Full Time |
| Registered Nurse 2.2 | 95.84% | Full Time |
| Registered Nurse 2.3 | 95.10% | Full Time |
| Registered Nurse 2.4 | 90.74% | Part Time 0.5 |
| TOTAL FTEE | | **8.5 FTEE** |

**Run 2**

| Resource | % Utilization | Status |
|---|---|---|
| Nursing Assistant 1.1 | 79.77% | Full Time |
| Nursing Assistant 1.2 | 77.98% | Part Time 0.5 |
| Nursing Assistant 2.1 | 83.06% | Full Time |
| Nursing Assistant 2.2 | 78.00% | Part Time 0.5 |
| Registered Nurse 1.1 | 95.78% | Full Time |
| Registered Nurse 1.2 | 96.39% | Full Time |
| Registered Nurse 1.3 | 96.27% | Full Time |
| Registered Nurse 2.1 | 93.78% | Full Time |
| Registered Nurse 2.2 | 93.24% | Full Time |
| Registered Nurse 2.3 | 93.97% | Full Time |
| TOTAL FTEE | | **9.0 FTEE** |

**Run 3**

| Resource | % Utilization | Status |
|---|---|---|
| Nursing Assistant 1 | 85.58% | Full Time |
| Nursing Assistant 2 | 84.15% | Full Time |
| Registered Nurse 1.1 | 92.39% | Full Time |
| Registered Nurse 1.2 | 92.78% | Full Time |
| Registered Nurse 1.3 | 93.55% | Full Time |
| Registered Nurse 1.4 | 85.79% | Part Time 0.5 |
| Registered Nurse 2.1 | 92.02% | Full Time |
| Registered Nurse 2.2 | 91.87% | Full Time |
| Registered Nurse 2.3 | 91.47% | Full Time |
| Registered Nurse 2.4 | 85.38% | Part Time 0.5 |
| TOTAL FTEE | | **9.0 FTEE** |

Table 4.7B Tuesday - Remaining Entities After The Day Shift
(Average of 52 Replications)

| Entity | RUN 1 | **RUN 2** | RUN 3 |
|---|---|---|---|
| ADL 1 | 0.40 | **0.13** | 0.28 |
| ADL 2 | 0.46 | **0.11** | 0.25 |
| Beginning Shift Report/Kardex 1 | 0.00 | **0.00** | 0.00 |
| Beginning Shift Report/Kardex 2 | 0.00 | **0.00** | 0.00 |
| Beginning Shift Report/Kardex 3 | 0.00 | **0.00** | 0.00 |
| Beginning Shift Report/Kardex 4 | 0.00 | **0.00** | 0.00 |
| Chart 1 | 2.44 | **1.55** | 1.17 |
| Chart 2 | 3.44 | **1.23** | 1.50 |
| Class Worksheet 1 | 0.11 | **0.00** | 0.05 |
| Class Worksheet 2 | 0.13 | **0.00** | 0.05 |
| Class Worksheet 3 | 0.23 | **0.05** | 0.19 |
| Class Worksheet 4 | 0.23 | **0.05** | 0.19 |
| Shift Final Report | 0.11 | **0.00** | 0.03 |
| End Shift Report/Kardex 1 | 0.11 | **0.00** | 0.03 |
| End Shift Report/Kardex 2 | 0.11 | **0.00** | 0.03 |
| End Shift Report/Kardex 3 | 0.26 | **0.03** | 0.21 |
| End Shift Report/Kardex 4 | 0.28 | **0.03** | 0.21 |
| Glucometer 1 | 0.15 | **0.03** | 0.11 |
| Glucometer 2 | 0.07 | **0.03** | 0.07 |
| Intake 1 | 0.09 | **0.00** | 0.03 |
| Intake 2 | 0.23 | **0.03** | 0.13 |
| Interaction 1 | 0.00 | **0.00** | 0.00 |
| Interaction 2 | 0.00 | **0.00** | 0.00 |
| Interaction 3 | 0.00 | **0.00** | 0.00 |
| Interaction 4 | 0.00 | **0.00** | 0.00 |
| Medicine 9-1 | 0.01 | **0.01** | 0.00 |
| Medicine 9-2 | 0.01 | **0.01** | 0.00 |
| Medicine 11-1 | 0.42 | **0.17** | 0.19 |
| Medicine 11-2 | 0.34 | **0.15** | 0.26 |
| Medicine 12-1 | 0.42 | **0.15** | 0.21 |
| Medicine 12-2 | 0.34 | **0.17** | 0.30 |
| Medicine 13-1 | 0.11 | **0.00** | 0.03 |
| Medicine 13-2 | 0.23 | **0.03** | 0.17 |
| Mini bag 9 | 0.46 | **0.26** | 0.32 |
| Mini bag 11 | 0.00 | **0.00** | 0.00 |
| Mini bag 13 | 0.55 | **0.30** | 0.48 |
| Morning Assignments | 0.00 | **0.00** | 0.00 |
| Narcotic Count | 0.30 | **0.15** | 0.13 |

| Table 4.7B (continued) | | | |
|---|---|---|---|
| Entity | RUN 1 | RUN 2 | RUN 3 |
| Order 1 | 2.55 | **0.48** | 1.94 |
| Order 2 | 1.30 | **0.80** | 1.46 |
| Patient Assessment 1 | 0.13 | **0.13** | 0.00 |
| Patient Assessment 2 | 0.00 | **0.11** | 0.00 |
| Patient In Chair 1 | 0.53 | **0.44** | 0.38 |
| Patient In Chair 2 | 0.48 | **0.32** | 0.30 |
| Patient Procedure 1 | 1.34 | **0.88** | 0.94 |
| Patient Procedure 2 | 1.17 | **0.71** | 0.55 |
| Patient Treatment 1 | 1.13 | **0.59** | 0.59 |
| Patient Treatment 2 | 1.09 | **0.46** | 1.09 |
| PRN 10-1 | 0.19 | **0.03** | 0.09 |
| PRN 10-2 | 0.07 | **0.05** | 0.07 |
| PRN 11-1 | 0.19 | **0.05** | 0.11 |
| PRN 11-2 | 0.32 | **0.13** | 0.25 |
| PRN 12-1 | 0.44 | **0.15** | 0.21 |
| PRN 12-2 | 0.34 | **0.17** | 0.30 |
| PRN 14-1 | 0.55 | **0.25** | 0.26 |
| PRN 14-2 | 0.48 | **0.23** | 0.32 |
| Patient Bath 1 | 0.88 | **0.40** | 0.35 |
| Patient Bath 2 | 0.76 | **0.28** | 0.48 |
| Patient Call 1 | 0.00 | **0.00** | 0.00 |
| Patient Call 2 | 0.00 | **0.00** | 0.00 |
| Patient Call 3 | 0.00 | **0.00** | 0.00 |
| Patient Call 4 | 0.00 | **0.00** | 0.00 |
| Telemetry Break | 0.65 | **0.19** | 0.32 |
| Telemetry Lunch | 0.26 | **0.00** | 0.17 |
| Telemetry Check 1 | 0.09 | **0.00** | 0.03 |
| Telemetry Check 2 | 0.11 | **0.00** | 0.03 |
| Telemetry Check 3 | 0.19 | **0.03** | 0.17 |
| Telemetry Check 4 | 0.19 | **0.03** | 0.17 |
| Telephone 1 | 0.00 | **0.00** | 0.00 |
| Telephone 2 | 0.00 | **0.00** | 0.00 |
| Telephone 3 | 0.00 | **0.00** | 0.00 |
| Telephone 4 | 0.00 | **0.00** | 0.00 |
| Tray 1 | 4.28 | **1.51** | 2.28 |
| Tray 2 | 4.03 | **1.11** | 3.26 |

| Table 4.7B (continued) | | | |
|---|---|---|---|
| Entity | RUN 1 | **RUN 2** | RUN 3 |
| Vital Sign 9-1 | 0.01 | **0.00** | 0.00 |
| Vital Sign 9-2 | 0.00 | **0.00** | 0.00 |
| Vital Sign 11-1 | 0.34 | **0.15** | 0.19 |
| Vital Sign 11-2 | 0.30 | **0.11** | 0.26 |
| Vital Sign 13-1 | 0.50 | **0.17** | 0.25 |
| Vital Sign 13-2 | 0.46 | **0.15** | 0.32 |
| Weight 1 | 0.38 | **0.19** | 0.36 |
| Weight 2 | 0.46 | **0.15** | 0.26 |

# Table 4.8A Wednesday - Activity Level and Resource Runs

| Activity | |
|---|---|
| Patients At 0700 | 19 |
| Admissions | 2 |
| Discharges | 1 |
| Transfers Onto Unit | 1 |
| Transfers Off Unit | 0 |
| Cardiac Catheterizations | 2 |
| COTC | 1 |
| Surgical Patients | 2 |
| Patients at 1600 | 22 |

**Run 1**

| Resource | % Utilization | Status |
|---|---|---|
| Nursing Assistant 1 | 88.74% | Full Time |
| Nursing Assistant 2 | 87.30% | Full Time |
| Registered Nurse 1.1 | 98.35% | Full Time |
| Registered Nurse 1.2 | 97.64% | Full Time |
| Registered Nurse 1.3 | 98.35% | Full Time |
| Registered Nurse 2.1 | 96.99% | Full Time |
| Registered Nurse 2.2 | 96.69% | Full Time |
| Registered Nurse 2.3 | 96.80% | Full Time |
| TOTAL FTEE | | **8.0 FTEE** |

**Run 2**

| Resource | % Utilization | Status |
|---|---|---|
| Nursing Assistant 1.1 | 83.69% | Full Time |
| Nursing Assistant 1.2 | 85.30% | Part Time 0.25 |
| Nursing Assistant 2.1 | 84.87% | Full Time |
| Nursing Assistant 2.2 | 88.58% | Part Time 0.25 |
| Registered Nurse 1.1 | 96.93% | Full Time |
| Registered Nurse 1.2 | 96.33% | Full Time |
| Registered Nurse 1.3 | 97.33% | Full Time |
| Registered Nurse 2.1 | 95.07% | Full Time |
| Registered Nurse 2.2 | 94.88% | Full Time |
| Registered Nurse 2.3 | 94.06% | Full Time |
| TOTAL FTEE | | **8.5 FTEE** |

**Run 3**

| Resource | % Utilization | Status |
|---|---|---|
| Nursing Assistant 1 | 86.19% | Full Time |
| Nursing Assistant 2 | 86.23% | Full Time |
| Registered Nurse 1.1 | 96.54% | Full Time |
| Registered Nurse 1.2 | 96.25% | Full Time |
| Registered Nurse 1.3 | 95.88% | Full Time |
| Registered Nurse 1.4 | 97.47% | Part Time 0.25 |
| Registered Nurse 2.1 | 92.86% | Full Time |
| Registered Nurse 2.2 | 93.55% | Full Time |
| Registered Nurse 2.3 | 91.87% | Full Time |
| Registered Nurse 2.4 | 91.13% | Part Time 0.25 |
| TOTAL FTEE | | **8.5 FTEE** |

Table 4.8B Wednesday - Remaining Entities After The Day Shift
(Average of 52 Replications)

| Entity | RUN 1 | RUN 2 | RUN 3 |
|---|---|---|---|
| ADL 1 | 0.65 | **0.23** | 0.38 |
| ADL 2 | 0.61 | **0.25** | 0.34 |
| Beginning Shift Report/Kardex 1 | 0.00 | **0.00** | 0.00 |
| Beginning Shift Report/Kardex 2 | 0.00 | **0.00** | 0.00 |
| Beginning Shift Report/Kardex 3 | 0.00 | **0.00** | 0.00 |
| Beginning Shift Report/Kardex 4 | 0.00 | **0.00** | 0.00 |
| Chart 1 | 5.30 | **0.92** | 1.86 |
| Chart 2 | 5.40 | **0.84** | 2.44 |
| Class Worksheet 1 | 0.25 | **0.01** | 0.09 |
| Class Worksheet 2 | 0.25 | **0.01** | 0.09 |
| Class Worksheet 3 | 0.42 | **0.11** | 0.19 |
| Class Worksheet 4 | 0.42 | **0.11** | 0.19 |
| Shift Final Report | 0.36 | **0.01** | 0.15 |
| End Shift Report/Kardex 1 | 0.34 | **0.01** | 0.15 |
| End Shift Report/Kardex 2 | 0.34 | **0.01** | 0.15 |
| End Shift Report/Kardex 3 | 0.48 | **0.15** | 0.21 |
| End Shift Report/Kardex 4 | 0.48 | **0.15** | 0.21 |
| Glucometer 1 | 0.26 | **0.05** | 0.13 |
| Glucometer 2 | 0.30 | **0.07** | 0.17 |
| Intake 1 | 0.32 | **0.01** | 0.15 |
| Intake 2 | 0.48 | **0.11** | 0.19 |
| Interaction 1 | 0.00 | **0.00** | 0.00 |
| Interaction 2 | 0.00 | **0.00** | 0.00 |
| Interaction 3 | 0.00 | **0.00** | 0.00 |
| Interaction 4 | 0.00 | **0.00** | 0.00 |
| Medicine 9-1 | 0.05 | **0.00** | 0.00 |
| Medicine 9-2 | 0.03 | **0.01** | 0.03 |
| Medicine 11-1 | 0.57 | **0.13** | 0.28 |
| Medicine 11-2 | 0.57 | **0.25** | 0.28 |
| Medicine 12-1 | 0.59 | **0.13** | 0.32 |
| Medicine 12-2 | 0.61 | **0.25** | 0.30 |
| Medicine 13-1 | 0.32 | **0.01** | 0.09 |
| Medicine 13-2 | 0.44 | **0.11** | 0.19 |
| Mini bag 9 | 0.80 | **0.24** | 0.55 |
| Mini bag 11 | 0.00 | **0.00** | 0.00 |
| Mini bag 13 | 1.13 | **0.55** | 0.69 |
| Morning Assignments | 0.00 | **0.00** | 0.00 |
| Narcotic Count | 0.53 | **0.23** | 0.17 |

| Table 4.8B (continued) | | | |
|---|---|---|---|
| Entity | RUN 1 | RUN 2 | RUN 3 |
| Order 1 | 3.55 | **1.05** | 1.73 |
| Order 2 | 3.92 | **0.94** | 1.61 |
| Patient Assessment 1 | 0.28 | **0.00** | 0.00 |
| Patient Assessment 2 | 0.25 | **0.00** | 0.01 |
| Patient In Chair 1 | 0.61 | **0.65** | 0.30 |
| Patient In Chair 2 | 0.38 | **0.40** | 0.40 |
| Patient Procedure 1 | 1.63 | **0.80** | 1.34 |
| Patient Procedure 2 | 1.40 | **0.86** | 1.03 |
| Patient Treatment 1 | 1.90 | **0.55** | 0.88 |
| Patient Treatment 2 | 1.76 | **0.82** | 1.00 |
| PRN 10-1 | 0.28 | **0.07** | 0.15 |
| PRN 10-2 | 0.34 | **0.11** | 0.19 |
| PRN 11-1 | 0.28 | **0.07** | 0.15 |
| PRN 11-2 | 0.57 | **0.23** | 0.28 |
| PRN 12-1 | 0.59 | **0.13** | 0.32 |
| PRN 12-2 | 0.61 | **0.25** | 0.30 |
| PRN 14-1 | 0.84 | **0.34** | 0.48 |
| PRN 14-2 | 0.71 | **0.32** | 0.38 |
| Patient Bath 1 | 1.59 | **0.40** | 0.61 |
| Patient Bath 2 | 1.42 | **0.17** | 0.67 |
| Patient Call 1 | 0.00 | **0.00** | 0.00 |
| Patient Call 2 | 0.03 | **0.00** | 0.00 |
| Patient Call 3 | 0.00 | **0.00** | 0.00 |
| Patient Call 4 | 0.00 | **0.00** | 0.00 |
| Telemetry Break | 0.84 | **0.38** | 0.50 |
| Telemetry Lunch | 0.50 | **0.07** | 0.19 |
| Telemetry Check 1 | 0.32 | **0.01** | 0.09 |
| Telemetry Check 2 | 0.32 | **0.01** | 0.09 |
| Telemetry Check 3 | 0.40 | **0.11** | 0.19 |
| Telemetry Check 4 | 0.42 | **0.11** | 0.19 |
| Telephone 1 | 0.00 | **0.00** | 0.00 |
| Telephone 2 | 0.00 | **0.00** | 0.00 |
| Telephone 3 | 0.00 | **0.00** | 0.00 |
| Telephone 4 | 0.00 | **0.00** | 0.00 |
| Tray 1 | 6.51 | **1.75** | 3.40 |
| Tray 2 | 6.05 | **2.28** | 3.19 |

| Table 4.8B (continued) | | | |
|---|---|---|---|
| Entity | RUN 1 | **RUN 2** | RUN 3 |
| Vital Sign 9-1 | 0.03 | **0.00** | 0.00 |
| Vital Sign 9-2 | 0.00 | **0.00** | 0.00 |
| Vital Sign 11-1 | 0.50 | **0.09** | 0.25 |
| Vital Sign 11-2 | 0.57 | **0.23** | 0.28 |
| Vital Sign 13-1 | 0.76 | **0.21** | 0.38 |
| Vital Sign 13-2 | 0.61 | **0.26** | 0.34 |
| Weight 1 | 0.61 | **0.19** | 0.36 |
| Weight 2 | 0.50 | **0.36** | 0.38 |

# Table 4.9A Thursday - Activity Level and Staffing Runs

| Activity | |
|---|---|
| Patients At 0700 | 20 |
| Admissions | 2 |
| Discharges | 3 |
| Transfers Onto Unit | 1 |
| Transfers Off Unit | 1 |
| Cardiac Catheterizations | 1 |
| COTC | 1 |
| Surgical Patients | 1 |
| Patients at 1600 | 20 |

**Run 1**

| Resource | % Utilization | Status |
|---|---|---|
| Nursing Assistant 1 | 89.62% | Full Time |
| Nursing Assistant 2 | 91.50% | Full Time |
| Registered Nurse 1.1 | 98.14% | Full Time |
| Registered Nurse 1.2 | 98.96% | Full Time |
| Registered Nurse 1.3 | 98.48% | Full Time |
| Registered Nurse 2.1 | 97.98% | Full Time |
| Registered Nurse 2.2 | 99.90% | Full Time |
| Registered Nurse 2.3 | 97.99% | Full Time |
| TOTAL FTEE | | **8.0 FTEE** |

**Run 2**

| Resource | % Utilization | Status |
|---|---|---|
| Nursing Assistant 1.1 | 83.89% | Full Time |
| Nursing Assistant 1.2 | 83.10% | Part Time 0.25 |
| Nursing Assistant 2.1 | 81.69% | Full Time |
| Nursing Assistant 2.2 | 84.48% | Part Time 0.25 |
| Registered Nurse 1.1 | 97.82% | Full Time |
| Registered Nurse 1.2 | 97.58% | Full Time |
| Registered Nurse 1.3 | 98.24% | Full Time |
| Registered Nurse 2.1 | 94.38% | Full Time |
| Registered Nurse 2.2 | 94.21% | Full Time |
| Registered Nurse 2.3 | 93.92% | Full Time |
| TOTAL FTEE | | **8.5 FTEE** |

**Run 3**

| Resource | % Utilization | Status |
|---|---|---|
| Nursing Assistant 1 | 83.04% | Full Time |
| Nursing Assistant 2 | 84.65% | Full Time |
| Registered Nurse 1.1 | 95.06% | Full Time |
| Registered Nurse 1.2 | 95.86% | Full Time |
| Registered Nurse 1.3 | 95.12% | Full Time |
| Registered Nurse 1.4 | 96.92% | Part Time 0.25 |
| Registered Nurse 2.1 | 89.87% | Full Time |
| Registered Nurse 2.2 | 89.67% | Full Time |
| Registered Nurse 2.3 | 89.59% | Full Time |
| Registered Nurse 2.4 | 90.25% | Part Time 0.25 |
| TOTAL FTEE | | **8.5 FTEE** |

Table 4.9B Thursday - Remaining Entities After The Day Shift
(Average of 52 Replications)

| Entity | RUN 1 | RUN 2 | RUN 3 |
|---|---|---|---|
| ADL 1 | 0.59 | **0.23** | 0.32 |
| ADL 2 | 0.63 | **0.28** | 0.40 |
| Beginning Shift Report/Kardex 1 | 0.00 | **0.00** | 0.00 |
| Beginning Shift Report/Kardex 2 | 0.00 | **0.00** | 0.00 |
| Beginning Shift Report/Kardex 3 | 0.00 | **0.00** | 0.00 |
| Beginning Shift Report/Kardex 4 | 0.00 | **0.00** | 0.00 |
| Chart 1 | 2.82 | **1.07** | 1.96 |
| Chart 2 | 3.26 | **1.28** | 2.25 |
| Class Worksheet 1 | 0.11 | **0.01** | 0.01 |
| Class Worksheet 2 | 0.13 | **0.01** | 0.01 |
| Class Worksheet 3 | 0.32 | **0.07** | 0.09 |
| Class Worksheet 4 | 0.32 | **0.07** | 0.09 |
| Shift Final Report | 0.11 | **0.01** | 0.09 |
| End Shift Report/Kardex 1 | 0.11 | **0.01** | 0.07 |
| End Shift Report/Kardex 2 | 0.11 | **0.01** | 0.07 |
| End Shift Report/Kardex 3 | 0.34 | **0.13** | 0.13 |
| End Shift Report/Kardex 4 | 0.34 | **0.13** | 0.13 |
| Glucometer 1 | 0.26 | **0.07** | 0.05 |
| Glucometer 2 | 0.13 | **0.00** | 0.00 |
| Intake 1 | 0.09 | **0.00** | 0.07 |
| Intake 2 | 0.32 | **0.13** | 0.13 |
| Interaction 1 | 0.00 | **0.00** | 0.00 |
| Interaction 2 | 0.00 | **0.00** | 0.00 |
| Interaction 3 | 0.00 | **0.00** | 0.00 |
| Interaction 4 | 0.00 | **0.00** | 0.00 |
| Medicine 9-1 | 0.01 | **0.01** | 0.00 |
| Medicine 9-2 | 0.01 | **0.00** | 0.00 |
| Medicine 11-1 | 0.34 | **0.19** | 0.28 |
| Medicine 11-2 | 0.48 | **0.17** | 0.17 |
| Medicine 12-1 | 0.40 | **0.19** | 0.30 |
| Medicine 12-2 | 0.51 | **0.23** | 0.23 |
| Medicine 13-1 | 0.09 | **0.01** | 0.03 |
| Medicine 13-2 | 0.32 | **0.11** | 0.09 |
| Mini bag 9 | 0.00 | **0.21** | 0.38 |
| Mini bag 11 | 0.00 | **0.00** | 0.00 |
| Mini bag 13 | 1.25 | **0.51** | 0.80 |
| Morning Assignments | 0.00 | **0.00** | 0.00 |
| Narcotic Count | 0.30 | **0.25** | 0.17 |

| Table 4.9B (continued) | | | |
|---|---|---|---|
| Entity | RUN 1 | RUN 2 | RUN 3 |
| Order 1 | 2.69 | **0.38** | 0.42 |
| Order 2 | 1.40 | **0.00** | 0.00 |
| Patient Assessment 1 | 0.15 | **0.17** | 0.00 |
| Patient Assessment 2 | 0.23 | **0.00** | 0.00 |
| Patient In Chair 1 | 0.50 | **0.40** | 0.50 |
| Patient In Chair 2 | 0.61 | **0.53** | 0.65 |
| Patient Procedure 1 | 1.28 | **0.76** | 0.59 |
| Patient Procedure 2 | 1.09 | **0.59** | 0.51 |
| Patient Treatment 1 | 1.36 | **0.67** | 0.98 |
| Patient Treatment 2 | 1.88 | **0.55** | 0.96 |
| PRN 10-1 | 0.25 | **0.07** | 0.03 |
| PRN 10-2 | 0.11 | **0.01** | 0.00 |
| PRN 11-1 | 0.26 | **0.07** | 0.05 |
| PRN 11-2 | 0.46 | **0.13** | 0.17 |
| PRN 12-1 | 0.42 | **0.19** | 0.30 |
| PRN 12-2 | 0.51 | **0.23** | 0.23 |
| PRN 14-1 | 0.53 | **0.38** | 0.38 |
| PRN 14-2 | 0.76 | **0.34** | 0.44 |
| Patient Bath 1 | 1.01 | **0.40** | 0.57 |
| Patient Bath 2 | 0.88 | **0.13** | 0.03 |
| Patient Call 1 | 0.00 | **0.00** | 0.00 |
| Patient Call 2 | 0.01 | **0.00** | 0.00 |
| Patient Call 3 | 0.00 | **0.00** | 0.00 |
| Patient Call 4 | 0.00 | **0.00** | 0.00 |
| Telemetry Break | 0.80 | **0.34** | 0.48 |
| Telemetry Lunch | 0.32 | **0.03** | 0.23 |
| Telemetry Check 1 | 0.09 | **0.01** | 0.03 |
| Telemetry Check 2 | 0.09 | **0.01** | 0.03 |
| Telemetry Check 3 | 0.32 | **0.07** | 0.09 |
| Telemetry Check 4 | 0.32 | **0.07** | 0.09 |
| Telephone 1 | 0.00 | **0.00** | 0.00 |
| Telephone 2 | 0.00 | **0.00** | 0.00 |
| Telephone 3 | 0.00 | **0.00** | 0.00 |
| Telephone 4 | 0.00 | **0.00** | 0.00 |
| Tray 1 | 4.73 | **2.38** | 3.03 |
| Tray 2 | 6.07 | **2.03** | 2.96 |

| Table 4.9B (continued) | | | |
|---|---|---|---|
| Entity | RUN 1 | **RUN 2** | RUN 3 |
| Vital Sign 9-1 | 0.01 | **0.01** | 0.00 |
| Vital Sign 9-2 | 0.00 | **0.00** | 0.00 |
| Vital Sign 11-1 | 0.30 | **0.13** | 0.23 |
| Vital Sign 11-2 | 0.46 | **0.09** | 0.15 |
| Vital Sign 13-1 | 0.50 | **0.25** | 0.28 |
| Vital Sign 13-2 | 0.63 | **0.26** | 0.36 |
| Weight 1 | 0.48 | **0.30** | 0.30 |
| Weight 2 | 0.50 | **0.23** | 0.30 |

# Table 4.10A Friday - Activity Level and Staffing Runs

| Activity | |
|---|---|
| Patients At 0700 | 19 |
| Admissions | 1 |
| Discharges | 3 |
| Transfers Onto Unit | 1 |
| Transfers Off Unit | 0 |
| Cardiac Catheterizations | 2 |
| COTC | 1 |
| Surgical Patients | 1 |
| Patients at 1600 | 19 |

**Run 1**

| Resource | % Utilization | Status |
|---|---|---|
| Nursing Assistant 1.1 | 91.10% | Full Time |
| Nursing Assistant 1.2 | 95.83% | Part Time 0.5 |
| Nursing Assistant 2.1 | 91.54% | Full Time |
| Nursing Assistant 2.2 | 94.73% | Part Time 0.5 |
| Registered Nurse 1.1 | 99.28% | Full Time |
| Registered Nurse 1.2 | 99.43% | Full Time |
| Registered Nurse 1.3 | 98.70% | Part Time 0.5 |
| Registered Nurse 2.1 | 98.90% | Full Time |
| Registered Nurse 2.2 | 99.00% | Full Time |
| Registered Nurse 2.3 | 98.33% | Part Time 0.5 |
| TOTAL FTEE | | **8.0 FTEE** |

**Run 2**

| Resource | % Utilization | Status |
|---|---|---|
| Nursing Assistant 1 | 85.35% | Full Time |
| Nursing Assistant 2 | 88.79% | Full Time |
| Registered Nurse 1.1 | 96.59% | Full Time |
| Registered Nurse 1.2 | 96.61% | Full Time |
| Registered Nurse 1.3 | 96.98% | Full Time |
| Registered Nurse 2.1 | 97.20% | Full Time |
| Registered Nurse 2.2 | 96.58% | Full Time |
| Registered Nurse 2.3 | 96.20% | Full Time |
| TOTAL FTEE | | **8.0 FTEE** |

**Run 3**

| Resource | % Utilization | Status |
|---|---|---|
| Nursing Assistant 1 | 81.64% | Full Time |
| Nursing Assistant 2 | 85.13% | Full Time |
| Registered Nurse 1.1 | 92.94% | Full Time |
| Registered Nurse 1.2 | 92.97% | Full Time |
| Registered Nurse 1.3 | 93.76% | Full Time |
| Registered Nurse 1.4 | 95.23% | Part Time 0.25 |
| Registered Nurse 2.1 | 93.16% | Full Time |
| Registered Nurse 2.2 | 93.41% | Full Time |
| Registered Nurse 2.3 | 92.64% | Full Time |
| Registered Nurse 2.4 | 91.91% | Part Time 0.25 |
| TOTAL FTEE | | **8.5 FTEE** |

Table 4.10B Friday - Remaining Entities After The Day Shift
(Average of 52 Replications)

| Entity | RUN 1 | RUN 2 | RUN 3 |
|---|---|---|---|
| ADL 1 | 0.25 | 0.40 | **0.30** |
| ADL 2 | 0.21 | 0.50 | **0.34** |
| Beginning Shift Report/Kardex 1 | 0.00 | 0.00 | **0.00** |
| Beginning Shift Report/Kardex 2 | 0.00 | 0.00 | **0.00** |
| Beginning Shift Report/Kardex 3 | 0.00 | 0.00 | **0.00** |
| Beginning Shift Report/Kardex 4 | 0.00 | 0.00 | **0.00** |
| Chart 1 | 3.50 | 3.01 | **1.48** |
| Chart 2 | 4.80 | 3.26 | **1.28** |
| Class Worksheet 1 | 0.00 | 0.09 | **0.00** |
| Class Worksheet 2 | 0.00 | 0.09 | **0.00** |
| Class Worksheet 3 | 0.05 | 0.25 | **0.11** |
| Class Worksheet 4 | 0.05 | 0.25 | **0.11** |
| Shift Final Report | 0.03 | 0.07 | **0.09** |
| End Shift Report/Kardex 1 | 0.03 | 0.09 | **0.07** |
| End Shift Report/Kardex 2 | 0.03 | 0.09 | **0.07** |
| End Shift Report/Kardex 3 | 0.05 | 0.28 | **0.19** |
| End Shift Report/Kardex 4 | 0.05 | 0.30 | **0.19** |
| Glucometer 1 | 0.23 | 0.21 | **0.09** |
| Glucometer 2 | 0.09 | 0.07 | **0.05** |
| Intake 1 | 0.01 | 0.07 | **0.05** |
| Intake 2 | 0.05 | 0.25 | **0.17** |
| Interaction 1 | 0.00 | 0.00 | **0.00** |
| Interaction 2 | 0.00 | 0.00 | **0.00** |
| Interaction 3 | 0.00 | 0.00 | **0.00** |
| Interaction 4 | 0.00 | 0.00 | **0.00** |
| Medicine 9-1 | 0.03 | 0.03 | **0.00** |
| Medicine 9-2 | 0.00 | 0.00 | **0.00** |
| Medicine 11-1 | 0.53 | 0.42 | **0.17** |
| Medicine 11-2 | 0.36 | 0.50 | **0.26** |
| Medicine 12-1 | 0.51 | 0.44 | **0.17** |
| Medicine 12-2 | 0.42 | 0.51 | **0.30** |
| Medicine 13-1 | 0.00 | 0.09 | **0.01** |
| Medicine 13-2 | 0.05 | 0.25 | **0.09** |
| Mini bag 9 | 0.90 | 0.65 | **0.44** |
| Mini bag 11 | 0.00 | 0.00 | **0.00** |
| Mini bag 13 | 0.73 | 1.05 | **0.38** |
| Morning Assignments | 0.00 | 0.00 | **0.00** |
| Narcotic Count | 0.23 | 0.32 | **0.21** |

| Table 4.10B (continued) | | | |
|---|---|---|---|
| Entity | RUN 1 | RUN 2 | RUN 3 |
| Order 1 | 2.92 | 2.36 | 1.05 |
| Order 2 | 1.21 | 0.75 | 0.73 |
| Patient Assessment 1 | 0.00 | 0.46 | 0.00 |
| Patient Assessment 2 | 0.00 | 0.00 | 0.00 |
| Patient In Chair 1 | 0.32 | 0.34 | 0.51 |
| Patient In Chair 2 | 0.36 | 0.42 | 0.50 |
| Patient Procedure 1 | 2.21 | 1.46 | 0.78 |
| Patient Procedure 2 | 2.05 | 1.09 | 0.94 |
| Patient Treatment 1 | 1.59 | 1.25 | 0.59 |
| Patient Treatment 2 | 1.07 | 1.19 | 1.21 |
| PRN 10-1 | 0.26 | 0.17 | 0.11 |
| PRN 10-2 | 0.11 | 0.13 | 0.07 |
| PRN 11-1 | 0.28 | 0.21 | 0.11 |
| PRN 11-2 | 0.32 | 0.48 | 0.25 |
| PRN 12-1 | 0.51 | 0.44 | 0.17 |
| PRN 12-2 | 0.44 | 0.51 | 0.30 |
| PRN 14-1 | 0.73 | 0.53 | 0.38 |
| PRN 14-2 | 0.63 | 0.53 | 0.34 |
| Patient Bath 1 | 1.09 | 0.96 | 0.40 |
| Patient Bath 2 | 0.78 | 0.50 | 0.44 |
| Patient Call 1 | 0.00 | 0.00 | 0.00 |
| Patient Call 2 | 0.00 | 0.00 | 0.00 |
| Patient Call 3 | 0.00 | 0.00 | 0.00 |
| Patient Call 4 | 0.00 | 0.00 | 0.00 |
| Telemetry Break | 0.59 | 0.53 | 0.42 |
| Telemetry Lunch | 0.00 | 0.28 | 0.09 |
| Telemetry Check 1 | 0.00 | 0.09 | 0.01 |
| Telemetry Check 2 | 0.00 | 0.09 | 0.01 |
| Telemetry Check 3 | 0.05 | 0.23 | 0.09 |
| Telemetry Check 4 | 0.05 | 0.23 | 0.09 |
| Telephone 1 | 0.00 | 0.00 | 0.00 |
| Telephone 2 | 0.00 | 0.00 | 0.00 |
| Telephone 3 | 0.00 | 0.00 | 0.00 |
| Telephone 4 | 0.00 | 0.00 | 0.00 |
| Tray 1 | 5.69 | 4.73 | 2.13 |
| Tray 2 | 3.90 | 4.65 | 3.48 |

| Table 4.10B (continued) | | | |
|---|---|---|---|
| Entity | RUN 1 | RUN 2 | **RUN 3** |
| Vital Sign 9-1 | 0.00 | 0.03 | **0.00** |
| Vital Sign 9-2 | 0.00 | 0.00 | **0.00** |
| Vital Sign 11-1 | 0.30 | 0.38 | **0.15** |
| Vital Sign 11-2 | 0.25 | 0.44 | **0.25** |
| Vital Sign 13-1 | 0.63 | 0.44 | **0.30** |
| Vital Sign 13-2 | 0.44 | 0.48 | **0.32** |
| Weight 1 | 0.44 | 0.42 | **0.26** |
| Weight 2 | 0.42 | 0.46 | **0.28** |

# Table 4.11A Saturday - Activity Level and Resource Runs

| Activity | |
|---|---|
| Patients At 0700 | 17 |
| Admissions | 1 |
| Discharges | 3 |
| Transfers Onto Unit | 0 |
| Transfers Off Unit | 0 |
| Cardiac Catheterizations | 0 |
| COTC | 0 |
| Surgical Patients | 0 |
| Patients at 1600 | 15 |

**Run 1**

| Resource | % Utilization | Status |
|---|---|---|
| Nursing Assistant 1 | 90.53% | Full Time |
| Nursing Assistant 2 | 91.40% | Full Time |
| Registered Nurse 1.1 | 98.58% | Full Time |
| Registered Nurse 1.2 | 98.38% | Part Time 0.5 |
| Registered Nurse 2.1 | 98.87% | Full Time |
| Registered Nurse 2.2 | 97.99% | Part Time 0.5 |
| TOTAL FTEE | | **5.0 FTEE** |

**Run 2**

| Resource | % Utilization | Status |
|---|---|---|
| Nursing Assistant 1 | 85.19% | Full Time |
| Nursing Assistant 2 | 92.93% | Part Time 0.5 |
| Registered Nurse 1.1 | 96.66% | Full Time |
| Registered Nurse 1.2 | 96.28% | Full Time |
| Registered Nurse 2.1 | 98.33% | Full Time |
| Registered Nurse 2.2 | 96.81% | Full Time |
| TOTAL FTEE | | **5.5 FTEE** |

**Run 3**

| Resource | % Utilization | Status |
|---|---|---|
| Nursing Assistant 1 | 77.75% | Full Time |
| Nursing Assistant 2 | 75.65% | Full Time |
| Registered Nurse 1.1 | 92.41% | Full Time |
| Registered Nurse 1.2 | 93.63% | Full Time |
| Registered Nurse 2.1 | 90.19% | Full Time |
| Registered Nurse 2.2 | 88.40% | Full Time |
| TOTAL FTEE | | **6.0 FTEE** |

Table 4.11B Saturday - Remaining Entities After The Day Shift
(Average of 52 Replications)

| Entity | RUN 1 | RUN 2 | RUN 3 |
|---|---|---|---|
| ADL 1 | 0.59 | 0.63 | **0.30** |
| ADL 2 | 0.55 | 0.53 | **0.32** |
| Beginning Shift Report/Kardex 1 | 0.00 | 0.00 | **0.00** |
| Beginning Shift Report/Kardex 2 | 0.00 | 0.00 | **0.00** |
| Beginning Shift Report/Kardex 3 | 0.00 | 0.00 | **0.00** |
| Beginning Shift Report/Kardex 4 | 0.00 | 0.00 | **0.00** |
| Chart 1 | 3.51 | 1.55 | **1.59** |
| Chart 2 | 4.71 | 2.71 | **2.25** |
| Class Worksheet 1 | 0.05 | 0.13 | **0.07** |
| Class Worksheet 2 | 0.05 | 0.13 | **0.07** |
| Class Worksheet 3 | 0.07 | 0.25 | **0.11** |
| Class Worksheet 4 | 0.07 | 0.25 | **0.11** |
| Shift Final Report | 0.11 | 0.13 | **0.07** |
| End Shift Report/Kardex 1 | 0.11 | 0.13 | **0.05** |
| End Shift Report/Kardex 2 | 0.11 | 0.13 | **0.05** |
| End Shift Report/Kardex 3 | 0.11 | 0.28 | **0.11** |
| End Shift Report/Kardex 4 | 0.11 | 0.30 | **0.11** |
| Glucometer 1 | 0.21 | 0.15 | **0.13** |
| Glucometer 2 | 0.28 | 0.23 | **0.05** |
| Intake 1 | 0.11 | 0.11 | **0.03** |
| Intake 2 | 0.11 | 0.21 | **0.07** |
| Interaction 1 | 0.00 | 0.00 | **0.00** |
| Interaction 2 | 0.00 | 0.00 | **0.00** |
| Interaction 3 | 0.00 | 0.00 | **0.00** |
| Interaction 4 | 0.00 | 0.00 | **0.00** |
| Medicine 9-1 | 0.00 | 0.00 | **0.00** |
| Medicine 9-2 | 0.00 | 0.00 | **0.00** |
| Medicine 11-1 | 0.65 | 0.40 | **0.32** |
| Medicine 11-2 | 0.57 | 0.44 | **0.17** |
| Medicine 12-1 | 0.65 | 0.40 | **0.32** |
| Medicine 12-2 | 0.65 | 0.44 | **0.21** |
| Medicine 13-1 | 0.03 | 0.13 | **0.03** |
| Medicine 13-2 | 0.09 | 0.17 | **0.09** |
| Mini bag 9 | 1.36 | 0.92 | **0.36** |
| Mini bag 11 | 0.00 | 0.00 | **0.00** |
| Mini bag 13 | 0.92 | 0.98 | **0.65** |
| Morning Assignments | 0.00 | 0.00 | **0.00** |
| Narcotic Count | 0.21 | 0.28 | **0.07** |

| Table 4.11B (continued) | | | |
|---|---|---|---|
| Entity | RUN 1 | RUN 2 | RUN 3 |
| Order 1 | 1.71 | 1.05 | **0.57** |
| Order 2 | 1.90 | 1.65 | **0.40** |
| Patient Assessment 1 | 0.00 | 0.00 | **0.00** |
| Patient Assessment 2 | 0.00 | 0.00 | **0.00** |
| Patient In Chair 1 | 0.17 | 0.46 | **0.30** |
| Patient In Chair 2 | 0.36 | 0.40 | **0.40** |
| Patient Procedure 1 | 0.82 | 0.38 | **0.23** |
| Patient Procedure 2 | 0.80 | 0.38 | **0.32** |
| Patient Treatment 1 | 1.26 | 1.05 | **0.59** |
| Patient Treatment 2 | 2.00 | 1.59 | **0.76** |
| PRN 10-1 | 0.26 | 0.15 | **0.09** |
| PRN 10-2 | 0.26 | 0.23 | **0.05** |
| PRN 11-1 | 0.28 | 0.17 | **0.13** |
| PRN 11-2 | 0.51 | 0.40 | **0.15** |
| PRN 12-1 | 0.65 | 0.40 | **0.32** |
| PRN 12-2 | 0.65 | 0.44 | **0.21** |
| PRN 14-1 | 0.78 | 0.61 | **0.38** |
| PRN 14-2 | 0.84 | 0.73 | **0.42** |
| Patient Bath 1 | 0.88 | 0.51 | **0.32** |
| Patient Bath 2 | 1.13 | 0.98 | **0.28** |
| Patient Call 1 | 0.00 | 0.00 | **0.00** |
| Patient Call 2 | 0.00 | 0.00 | **0.00** |
| Patient Call 3 | 0.00 | 0.00 | **0.00** |
| Patient Call 4 | 0.00 | 0.00 | **0.00** |
| Telemetry Break | 0.94 | 0.67 | **0.36** |
| Telemetry Lunch | 0.42 | 0.36 | **0.28** |
| Telemetry Check 1 | 0.03 | 0.13 | **0.03** |
| Telemetry Check 2 | 0.03 | 0.13 | **0.03** |
| Telemetry Check 3 | 0.09 | 0.07 | **0.07** |
| Telemetry Check 4 | 0.09 | 0.17 | **0.07** |
| Telephone 1 | 0.00 | 0.00 | **0.00** |
| Telephone 2 | 0.00 | 0.00 | **0.00** |
| Telephone 3 | 0.00 | 0.00 | **0.00** |
| Telephone 4 | 0.00 | 0.00 | **0.00** |
| Tray 1 | 5.17 | 3.34 | **2.59** |
| Tray 2 | 7.01 | 5.63 | **2.71** |

| Table 4.11B (continued) | | | |
|---|---|---|---|
| Entity | RUN 1 | RUN 2 | **RUN 3** |
| Vital Sign 9-1 | 0.00 | 0.00 | **0.00** |
| Vital Sign 9-2 | 0.00 | 0.00 | **0.00** |
| Vital Sign 11-1 | 0.51 | 0.30 | **0.28** |
| Vital Sign 11-2 | 0.53 | 0.44 | **0.15** |
| Vital Sign 13-1 | 0.73 | 0.48 | **0.34** |
| Vital Sign 13-2 | 0.78 | 0.71 | **0.36** |
| Weight 1 | 0.67 | 0.55 | **0.28** |
| Weight 2 | 0.73 | 0.57 | **0.03** |

# CHAPTER 5

# EXPECTED FINDINGS AND UTILITY OF RESULTS

The results of the computer simulation for 5CN provided top management at the Milwaukee VAMC with objective, measurable data supporting the identified nurse staffing. Once the identified nurse staffing is validated with community practice, then top management and nurse executives will need to discuss the identified nurse staffing and agree on nursing FTEE.

Although the collection of data and programming of the model was time intensive, the model is now an invaluable tool. An example would be if the nursing staff of 5CN was asked to take on a respiratory therapy function. In this respiratory therapy scenario the model could easily be reprogrammed to include the respiratory therapy task and identify if additional resources would be required or if the current resources could incorporate this task into their daily routine. Another example may be the shifting of nursing duties from one shift to another.

# CHAPTER 6

# RESULTS and RECOMMENDATIONS

While running the simulation of 5CN, the researcher continued to vary the staffing levels, after reviewing the nurse staff utilization and the amount of entities remaining in the system from previous runs. The researcher varied the nurse staffing until three scenarios were close to the results she wanted to achieve. The three staffing scenarios for each day of the week are captured in the tables above. The bolded nurse staffing runs are the runs the researcher chose as the optimal staffing level and are outlined in Table 5.1.

Table 6.1 Nurse Staffing Recommendations for 5CN's Day Shift

| | SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|---|
| Registered Nurses | 4.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.5 | 4.0 |
| Nursing Assistants | 1.5 | 1.5 | 3.0 | 2.5 | 2.5 | 2.0 | 2.0 |
| Total FTEE | 5.5 | 7.5 | 9.0 | 8.5 | 8.5 | 8.5 | 6.0 |
| Average Census at the Beginning of the Shift | 16 | 17 | 19 | 19 | 20 | 19 | 17 |

The nurse staffing recommendations are based on the average daily census of the unit at the beginning of the shift and the projected activity level of the unit. These staffing numbers do not include a telemetry technician. The numbers do include relieving the telemetry technician for breaks and lunches, but does not include the telemetry technician's FTEE.

The researcher was surprised with the number of nursing employees required to complete all the nursing activities on this unit's day shift. Further simulation will be required before definite nurse staffing numbers will be recommended. The evening and night shifts will need to be simulated to determine if some of these nursing activities of the day shift can be taken on by the other shifts and identify the staffing recommendations for the other shifts.

Another area the researcher identified as requiring further investigation is the frequency of items being performed. An example of this is the frequency of medications. Not all patients receive medications at each of these time intervals, but medications are ordered for the following time intervals during the day shift: 9:00 AM, 10:00 AM, 11:00 AM, 12:00 PM, 1:00 PM, 2:00 PM. and 3:00 PM. The researcher questions if these times could be consolidated into a smaller group of time intervals.

Additionally, the researcher has identified a need for coordinating care with the physicians. Often physicians order tests, vital signs, or treatments, etc. and they forget to discontinue the order when it is no longer required or decrease the frequency of the order. Communication with physicians is essential in coordinating patient care and in decreasing nursing workload.

# CHAPTER 7

# CONCLUSION

Computer simulation has offered an interesting approach to nurse staffing. It has provided the top management team at the Milwaukee VAMC with objective, measurable data. However, further simulation will need to be performed before the top management team will make any decisions on nurse staffing. Simulation will need to be completed on all three shifts along with staffing requirements that vary from the average census. Once these simulations are completed, the top management team and nurse executives will be able to discuss and make rational decisions on nurse staffing.

# ATTACHMENT A

# ACUTE CARE NURSING QUALITY INDICATORS

## PATIENT-FOCUSED OUTCOME INDICATORS

* Mortality Rate
* Length of Stay
* Adverse Incidents
  - Adverse Incident Rate (total)
  - Medication Error Rate
  - Patient Injury Rate
* Complications
  - Total Complication Rate
  - Decubitus Ulcer Rate
  - Nosocomial Infection Rate (total)
  - Nosocomial Urinary Tract Infection Rate
  - Nosocomial Pneumonia Rate
  - Nosocomial Surgical Wound Infection Rate
* Patient/Family Satisfaction with Nursing Care
  - Patient Willingness to Recommend Hospital to Others/Use Hospital Again
* Patient Adherence to Discharge Plan
  - Readmission Rates
  - Emergency Room Visits Post-Discharge
  - Unscheduled Physician Visits Post-Discharge
  - Patient Knowledge of Disease/Condition and Care Requirements

## PROCESS OF CARE INDICATORS

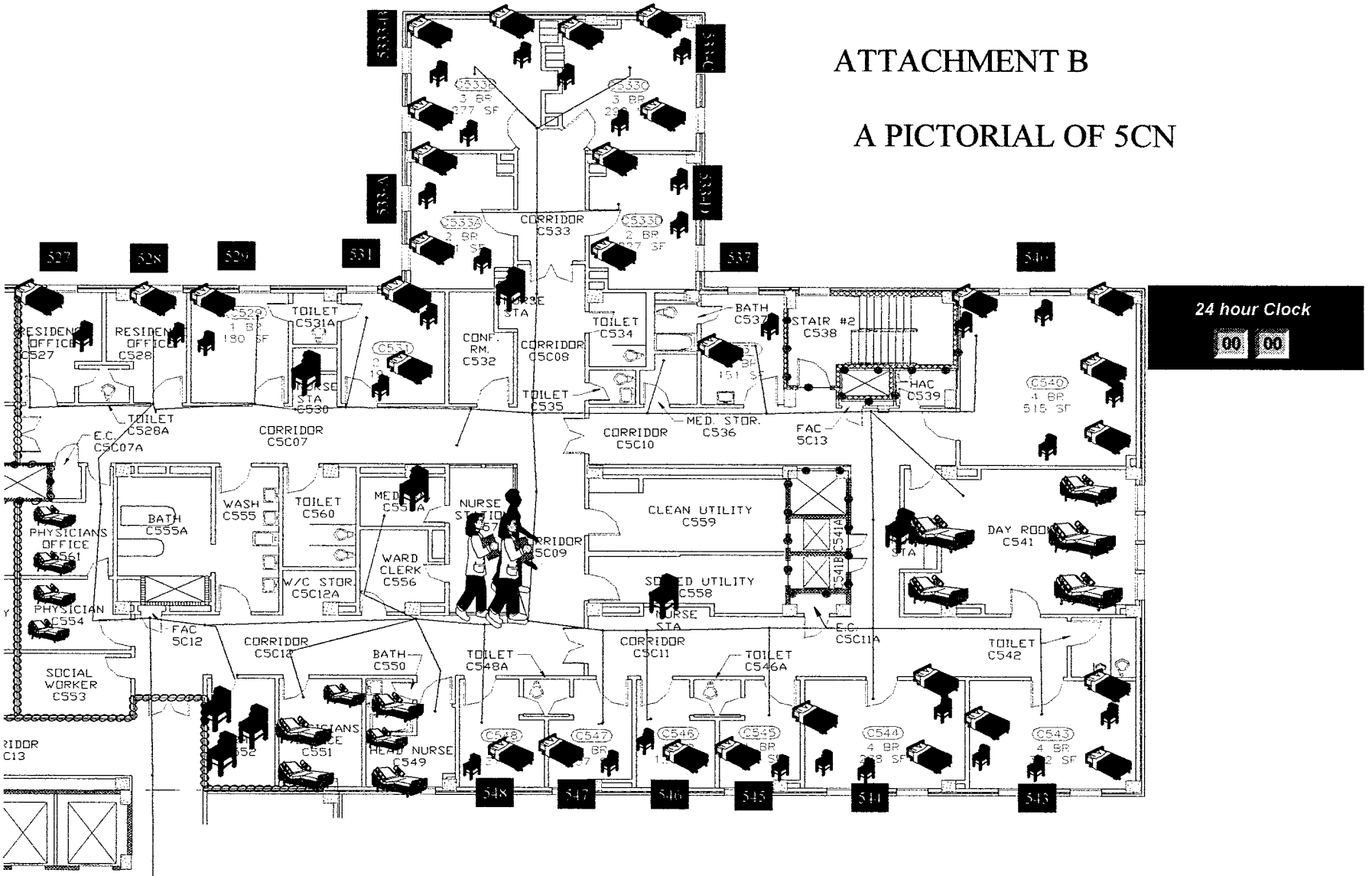
* Nurse Satisfaction
* Assessment and Implementation of Patient Care Requirements
  - Assessment of Patient Care Requirements
  - Development of Nursing Care Plan
  - Accurate and Timely Execution of Therapeutic Interventions and Procedures
  - Documentation of Nursing Diagnoses, Therapeutic Objectives, and Care Given
* Pain Management
* Maintenance of Skin Integrity
* Patient Education
* Discharge Planning
* Assurance of Patient Safety
  - Overall Assurance of Patient Safety
  - Appropriate Use of Restraints (all)
  - Appropriate Use of Pharmaceutical Restraints
  - Appropriate Use of Physical Restraints
* Responsiveness to Unplanned Patient Care Needs

## STRUCTURE OF CARE INDICATORS-NURSE STAFFING PATTERNS

* Ratio of Total Nursing Staff to Patients
  - RN/Patient Ratio
  - LPN/Patient Ratio
  - Unlicensed Workers/Patient Ratio
* Ratio of RNs to Total Nursing Staff
  - Mix of RNs, LPNs, and Unlicensed workers
* RN Staff Qualifications
  - RN Staff Experience
  - RN Staff Education (i.e., MSNs, BSNs)
* Total Nursing Care Hours Provided Per Patient (Case Mix, Acuity Adjusted)
  - RN Hours per Patient
  - LPN Hours per Patient
  - Unlicensed Worker Hours per Patient
* Staff Continuity
  - Use of Agency Nurses
  - Use of Float Nurses
  - Unsafe Assignment Rate
  - Nurse Staff Turnover Rates
  - FT/PT RN Ratio
* RN Overtime
* Nursing Staff Injury Rate

# ATTACHMENT B

# A PICTORIAL OF 5CN



# Attachment C
## Array of Patient Care Activities

| Patient Care Activity | Row Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9AM vitals | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 11AM vitals | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 1PM vitals | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9AM meds | 4 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 11AM meds | 5 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 12PM meds | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 1PM meds | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2PM meds | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 9AM meds | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11AM mini bag | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1PM mini bag | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 8AM prn | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 9AM prn | 13 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10AM prn | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11AM prn | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 12PM prn | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1PM prn | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2PM prn | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3PM prn | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9AM treatments | 20 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1PM treatments | 21 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 |
| Bed scale wt. | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ADL sheets | 23 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Bathing | 24 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Bed changes | 25 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Finger sticks | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| Intak and Output | 27 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| Procedures | 28 | 0 | 1 | 2 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 2 | 1 | 0 | 0 | 2 | 2 | 2 | 0 | 2 | 0 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 |
| Physical Therapy | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| Surgical Patients | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cardiac Cath. Pt. | 31 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Discharge Pt. | 32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| Transfer Out | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Pt. Assessment | 34 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Trays | 35 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 2 | 0 | 2 | 0 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

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